FORELIMB MYOLOGY AND THE EVOLUTIONARY RELATIONSHIPS OF THE AARDVARK, *ORYCTEROPUS AFER*, AND OTHER SMALL AFROTHERES

by

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ABSTRACT

The aardvark, *Orycteropus afer*, is the sole surviving member of the order Tubulidentata, and it has such unusual morphology that few skeletal or dental characters link it to other living mammals. Instead researchers compare the skeleton of *Orycteropus* with bones from extinct primitive ungulates, the condylarths. Recent genetic research places *Orycteropus* in Afrotheria, a grouping of mammals that conflicts with conventional mammalian systematics based on morphology and finds little support from fossil evidence (Stanhope et al., 1998). Thus the evolutionary relationships of *Orycteropus* are highly controversial.

This dissertation utilizes detailed dissection-based information about the forelimb myology of the aardvark and other small afrotheres, and similar information available in the literature for most other mammals, to bolster the morphological evidence for the position of the aardvark within Eutheria. The dissected mammals were the afrotheres *Orycteropus afer*, *Potamogale velox, Microgale dobsoni, Calcochloris leucorhinus* (described for the first time)*, Rhynchocyon cirnei, Elephantulus brachyrhynchus, Petrodromus tetradactylus, Procavia capensis, Heterohyrax brucei,* and artiodactyls *Pecari tajacu,* and *Tragulus napu* for comparison.

A total of 60 characters were identified and scored for 46 orders or families of mammals, and the program Mesquite 2.75 used for a parsimony analysis. The 50% majority rules consensus tree of 178 trees indicates that forelimb myology places *Orycteropus* as basal within eutherian mammals along with Tenrecidae and Macroscelididae rather than with the paenungulates and ungulates. The forelimb myology characters, particularly features of the flexor muscles of the forearm and the muscles of the manus, indicate that *Orycteropus* is most closely related to Chrysochloridae and Tenrecidae (Afrosoricida) with Macroscelididae as the sister group to this clade, together comprising Afroinsectiphilia. Xenarthra are clearly unrelated to *Orycteropus*, but also retain many primitive features. The forelimb myology of the ungulates is quite derived in comparison with *Orycteropus*; Paenungulata do share many similarities with the ungulates, however, but still retain some primitive features in common with *Orycteropus*.

In addition to myological features linking *Orycteropus* with the Afrosoricida, some possible myological synapomorphies for Afrotheria are identified, notably an unusual muscle identified here as m. cubitalis. This indicates there may be morphological support for Afrotheria in the myology.

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PREFACE

"The Orycteropes have been long confounded with the Ant-eaters, inasmuch as they subsist on the same food, have a similar-formed head, and a tongue which is somewhat extensible; but they are distinguished by having grinding teeth, and flat claws, adapted for burrowing rather than for cutting open ant-hills. The structure of their teeth is different from that of all other quadrupeds; they are solid cylinders, traversed, like reeds, in a longitudinal direction, by an infinitude of little canals. The stomach is simple, and muscular towards its outlet, and the caecum small and obtuse. Only one species is known of this genus, the Cape Orycterope (*Myrmecophaga capensis*), which the Dutch colonists style the Ground Hog. It is an animal about the size of a Badger or larger, low upon the legs, with scanty greyish-brown hair, and tail shorter than the body and as little clad. It inhabits burrows, which it forms with extreme rapidity; and its flesh is eaten."

- Baron Georges Cuvier, 1849

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CHAPTER 1 – INTRODUCTION

The aardvark, *Orycteropus afer*

The aardvark, *Orycteropus afer*, is a medium-sized (40-100 kg) quadrupedal mammal. It possesses a head with large pinnae, small eyes, and an elongate snout tipped with hairy nostrils, extremely powerful forelimbs with four digits and hind limbs with five digits, an arched back, and a large and strong tail. It is myrmecophagous, using its powerful limbs to dig through termite mounds and ant hills, and its long, sticky tongue to consume its insect prey. Its unique ever-growing teeth are made up of tubes of dentine, but are featureless when compared to the specific patterns of enamel-covered cusps, crests, and basins found on the teeth of most other mammals (Shoshani et al., 1988).

This unusual creature is the sole surviving member of the family Orycteropodidae and order Tubulidentata. Over the past 150 years many scientists have attempted to ascertain the position of the aardvark within mammalian phylogeny, comparing the bony and soft tissue anatomy and molecular biology of the aardvark with other living mammals and with fossil groups (Gray, 1865; Humphry, 1868; Galton, 1870; Huxley, 1872; Flower, 1882; Parker, 1885; Smith, 1898; Windle & Parsons, 1899; Weber, 1904; Broom, 1906, 1909; Lönnberg, 1906; Gregory, 1910; Edgeworth, 1924; Pocock, 1924; Sonntag, 1925; Sonntag & Woollard, 1925; Coupin, 1926; Le Gros Clark & Sonntag, 1926; Jepsen, 1932; Frechkop, 1937; Matthew, 1937; Colbert, 1941; Simpson, 1945; Lavocat, 1958; McKenna, 1975; Patterson, 1975, 1978; Melton, 1976; de Jong et al., 1981; Novacek, 1982; Thewissen, 1985; Miyamoto & Goodman, 1986; Novacek & Wyss, 1986; Prothero et al., 1988; MacPhee, 1994; Gaudin et al., 1996; Porter et al., 1996; Shoshani & McKenna, 1998; Stanhope et al., 1998; Arnason et al., 1999; Werdelin & Nilsonne, 1999; Madsen et al., 2001; Murphy et al., 2001; Malia et al., 2002; Scally et al., 2002; Waddell & Shelley, 2003; Carter et al., 2004; Robinson & Seiffert, 2004; Holroyd & Mussell, 2005; Cox, 2006; Sánchez-Villagra et al., 2007; Seiffert, 2007; Asher & Lehmann, 2008; Asher & Olbricht, 2009; Holroyd, 2010; Buckley, 2013; O'Leary et al., 2013). While modern molecular research consistently indicates that the order Tubulidentata belongs in the clade Afrotheria (Fig. 1A) with the orders Hyracoidea, Proboscidea, Sirenia, Macroscelidea, and Afrosoricida (families Tenrecidae and Chryoschloridae), the interordinal relationships of Tubulidentata within Afrotheria are not certain and "there is no strong consensus from morphological phylogenies on its position within Eutheria" (Tabuce et al., 2008: 8).

This dissertation utilizes detailed dissection-based information about the forelimb myology of the aardvark and other small afrotheres, and similar information available in the literature for other mammals, to determine whether myological data supports the molecular view of Afrotheria or a different hypothesis of evolutionary relationships.

History of hypotheses of aardvark evolutionary relationships

From the late 18th century until the beginning of the 20th century, palaeontologists and mammalogists grouped the aardvark in the now defunct order "Edentata," together with pangolins, anteaters, and sloths (Cuvier, 1849; Gray, 1865). This idea of the aardvark's evolutionary relationships influenced early studies of anatomy and the taxa to which aardvarks were compared. Flower (1882) and Windle & Parsons (1899) both investigated the anatomy of edentates and failed to find any particular morphological features linking *Orycteropus* with the other edentates. As the "Edentata" fell out of favor under the weight of anatomical evidence, Weber (1904) followed Huxley's (1872) suggestion and finally split up the artificial grouping and established the Order Tubulidentata, with the aardvark as the sole surviving member.

Others interpreted the aardvark as a basal mammal of uncertain affinity. Based on cranial anatomy, Parker (1885) suggested that *Orycteropus* may have originated from a marsupial. Broom (1909) also thought the primitive appearance of the Jacobson's organ in the aardvark was suggestive of marsupials, and the additional evidence of "six premolars" indicated a relationship closer to Mesozoic mammals (Broom, 1906). Jepsen (1932) believed that fossil *Tubulodon* from the Eocene of Wyoming was a tubulidentate with a mandible too specialized to have evolved from any known Paleocene mammal; thus he concluded that both *Tubulodon* and *Orycteropus* must have descended from a Mesozoic mammal. *Tubulodon* is now known to be a palaeanodont, not a tubulidentate (Rose, 2008), but all of the above suggestions left Tubulidentata as an isolated, early diverging order and gave little insight on its true relationships.

A more promising hypothesis linked the aardvark with Paleocene-Eocene basal ungulates, the condylarths. This alliance with the condylarths was first suggested by Smith (1898) in his work on brain morphology of edentates. Lönnberg's (1906) examination of the unusual teeth of the aardvark also revealed a possible derivation from the condylarths, and paleontologist W.K. Gregory (1910) pointed out features of the astragalus linking the aardvark with the condylarths. This evolutionary hypothesis received substantial support from Sonntag (1925) and Le Gros Clark & Sonntag (1926), who compared the anatomy of *Orycteropus* with that of edentates and other mammals, in order to suggest evolutionary relationships. They concluded that the musculo-skeletal anatomy indicates that aardvarks probably arose from stem Condylarthra and evolved similarly to Hyracoidea and Proboscidea and thus should be included in the Ungulata (hoofed mammals). Other anatomical research on the subject, such as Sonntag & Woollard (1925) on the brain, Coupin (1926) on endoturbinals, and Frechkop (1937) on the feet, reached similar conclusions. Another paleontologist, W. D. Matthew (1937), compared the skeleton of *Orycteropus* with the Paleocene periptychid condylarth *Ectoconus* and found the resemblance striking, particularly in the pes. A subsequent statistical analysis by Colbert (1941) used deformed coordinates to examine extant and fossil skeletal elements, and the results strongly supported a condylarth ancestry for the Tubulidentata.

The argument for the origin of the aardvark from Condylarthra thus seemed to be supported by these well-documented anatomical similarities; consequently, G. G. Simpson (1945) in his classification of mammals placed the aardvark in the Superorder Protungulata together with Condylarthra and some extinct South American ungulates. Many subsequent summaries agreed (Kingdon, 1974; Patterson 1975, 1978; Melton, 1976). Tubulidentata remained in a basal ungulate position in Paenungulata (along with Orders Proboscidea, Sirenia, Hyracoidea, and related fossils) in subsequent classifications of mammals (McKenna, 1975; McKenna & Bell, 1997; Anderson & Jones, 1984). See Figure 1B for a cladogram depicting this view of mammalian relationships.

The advent of molecular phylogenetic analyses seemed to solidify this position, as seen in a tree based on alpha-crystallin lens proteins and another tree based on seven polypeptide proteins supported the aardvark's relationship with the Paenungulata (de Jong et al., 1981; Miyamoto & Goodman, 1986).

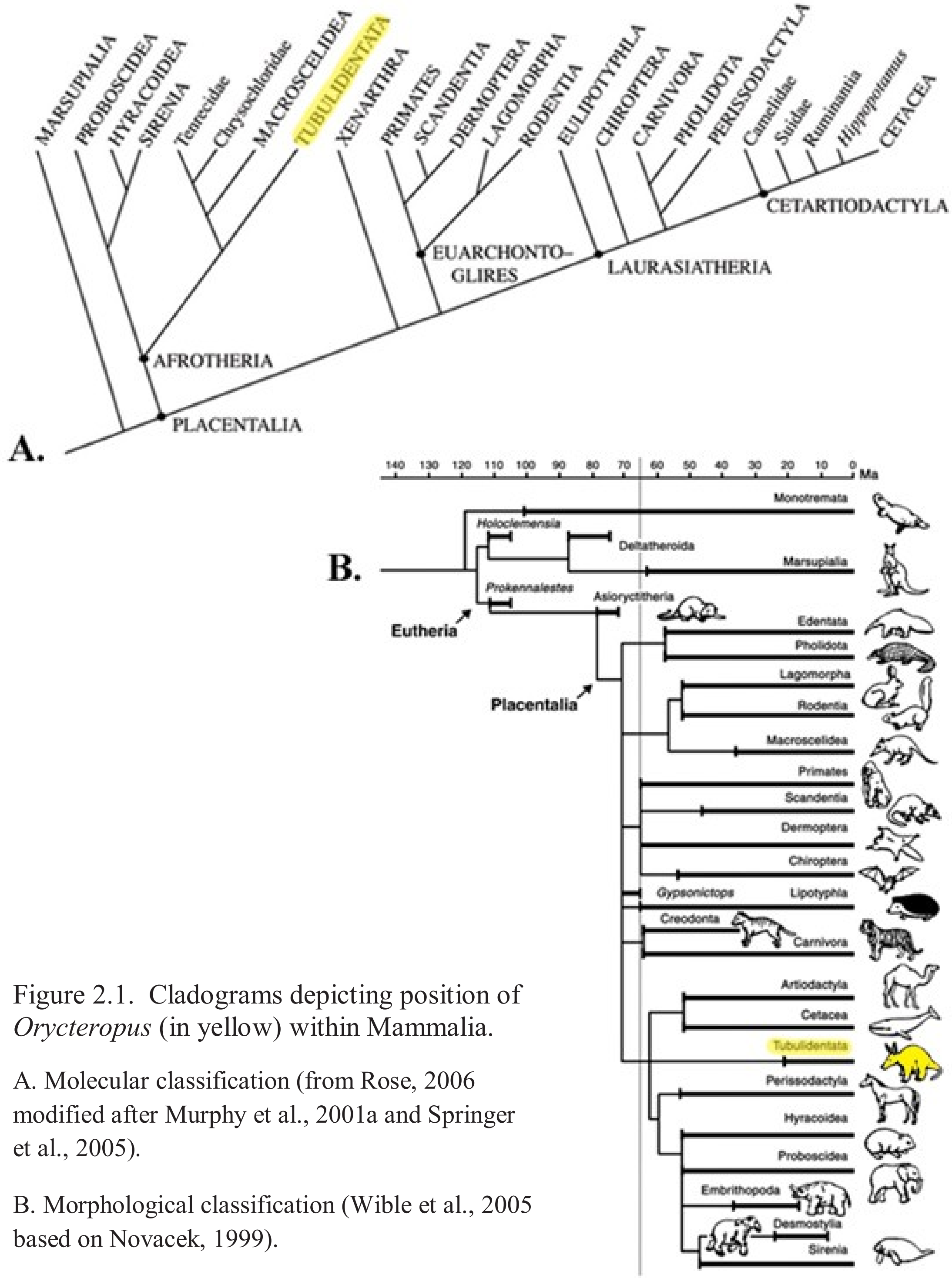


Figure 2.1. Cladograms depicting position of *Orycteropus* (in yellow) within Mammalia.

A. Molecular classification (from Rose, 2006 modified after Murphy et al., 2001a and Springer et al., 2005).

B. Morphological classification (Wible et al., 2005 based on Novacek, 1999).

In the 1980s, however, the increasing popularity of computerized phylogenetic analyses based on dental and osteological characters began to shuffle Tubulidentata throughout the Eutheria, rather than allying the order with ungulates (Holroyd & Mussel, 2005). For example, in Novacek & Wyss (1986) the aardvark formed a polytomy with all Eutheria except Xenarthra and the Ungulata. An analysis of characters of the stapes and foramen ovale linked Tubulidentata with Insectivora and Carnivora (Gaudin et al., 1996). Novacek (1992) also found several trees joining Tubulidentata with Insectivora and Carnivora. Adding to the confusion, even anatomical studies at this time separated the aardvark from ungulates: Thewissen (1985) utilized characters of the cranial arterial supply to challenge the similarity between the Ungulata and Tubulidentata, though he did not offer an alternative hypothesis for the aardvark's relationships. Still, other cladistic analyses published during this time maintained that Tubulidentata is indeed of ungulate stock (Novacek, 1982; Shoshani, 1986; Prothero et al., 1988; Shoshani & McKenna, 1998), and MacPhee (1994) used skeletal characters to recover trees placing the aardvark as the sister taxon to the hyracoids or *Meniscotherium*, a phenacodontid condylarth.

With the dawn of the 21st century came yet another hypothesis about the evolutionary relationships of *Orycteropus afer*: the Afrotheria hypothesis (Figure 1A). First proposed by Stanhope et al. (1998), utilizing 2.6 kb of mitochondrial and nuclear genes, Afrotheria is a superorder joining the orders Proboscidea, Sirenia, and Hyracoidea (conventional Paenungulata), together with Tubulidentata, Macroscelidea, and two former lipotyphlan insectivore families, the Chrysochloridae and Tenrecidae (now Order Afrosoricida or superfamily Tenrecoidea). Subsequent genetic work maintains and strongly supports Afrotheria and reveals rare genetic changes within the group (Springer et al., 1999; Madsen et al., 2001; Murphy et al., 2001a, 2001b; van Dijk et al., 2001;

Scally et al., 2002; Asher et al., 2003; Springer et al., 2005; Wildman et al., 2007), concomitantly splitting apart the conventional Ungulata and Lipotyphla clades.

The proponents of the Afrotheria hypothesis noted that "anatomical studies have not yet provided support for such a diverse African clade, and indeed there is not a single morphological synapomorphy that defines Afrotheria" (Stanhope et al., 1998: 9971; see also Hedges, 2001; Rose, 2006). Research in the past decade has resulted in several potential anatomical synapomorphies for some of the members of Afrotheria: dental eruption patterns (Asher & Lehmann, 2008; Asher & Olbricht, 2009), four possible dental synapomorphies (Seiffert, 2003), fetal membranes (Carter et al., 2004, 2006), the number and variation of the thoracolumbar vertebrae (Sánchez-Villagra et al., 2007; Seiffert, 2007), characters of the ankle (Zack et al., 2005; Seiffert 2007; Tabuce et al., 2007), fusion of the proximal tibia and fibula (Asher & Seiffert, 2010), and testicondy (Werdelin & Nilsonne, 1999). However, anatomical synapomorphies that unambiguously define all of Afrotheria are still lacking (Cote et al., 2007; Asher & Seiffert, 2008; Asher & Seiffert, 2010).

In addition, the position of tubulidentates within Afrotheria is still not certain (Robinson & Seiffert, 2004; Seiffert, 2007; Asher et al., 2009; Asher & Seiffert, 2010). Phylogenies based on molecules generally, though not always, indicate a dichotomy between the Paenungulata (Proboscidea, Hyracoidea, and Sirenia) and the Afroinsectivora (Tenrecoidae, Chrysochloridae, Macroscelidea). However, Tubulidentata has been variously placed as the sister taxon of Chrysochloridae (Kjer & Honeycutt, 2007; Murphy et al., 2007), Tenrecidae (Waddell & Shelley, 2003), Macroscelidae (Springer & Murphy, 2007), Paenungulata (Seiffert, 2007; O'Leary et al., 2013), Afrosoricida (Waddell & Shelley, 2003), Afroinsectivora (Delsuc et al., 2002; Amrine-Madsen et al., 2003; Asher, 2007; Murphy et al., 2007; Arnason et al., 2008; Meredith et al., 2011), and even as the most basal taxon within Afrotheria (Malia et al., 2002). Moreover, the overall position of the clade Afrotheria is also uncertain (Asher et al., 2009). Some studies indicate that Afrotheria is the sister clade to Xenarthra and that this Atlantogeneta clade is the root of the eutherian tree (Stanhope et al., 1998; Murphy et al., 2007; Asher et al., 2009; Meredith et al., 2011; Morgan et al., 2013), while others indicate that Afrotheria itself might be at the root of the tree (Murphy et al., 2001b; Delsuc et al., 2002; Waddell & Shelley, 2003; Kjer & Honeycutt, 2007; Asher, 2007). Thus, despite the strong genetic signal for the inclusion of the aardvark in the clade Afrotheria, much is left unresolved about its evolutionary relationships.

Paleontological evidence for aardvark evolutionary relationships

Aside from the comparisons with condylarths, which might not be valid (Robinson & Seiffert, 2004), fossils are notably lacking from the above discussion. A comprehensive fossil record for Afrotheria is lacking, and this has resulted in most analyses based on the morphology or molecular biology of living crown group species (Asher et al., 2003; Tabuce et al., 2007). The aardvark today is the only member of Tubulidentata and lives only in sub-Saharan Africa (Shoshani et al., 1988). However, fossils from the Pleistocene, Pliocene, and Miocene, the earliest from Kenya 20 million years ago, indicate that at least a dozen other species of *Orycteropus* and three other tubulidentate genera, *Leptorycteropus*, *Myorycteropus*, and *Amphiorycteropus*, once existed in the Middle East, Pakistan, and Europe (Lehmann, 2009). While these tubulidentate fossils hint at an interesting evolutionary history, their morphology is so similar to the modern aardvark that they do not provide any clues for broader evolutionary relationships.

There are some other intriguing fossils that might possibly be related to Tubulidentata. The first is the enigmatic subfossil *Plesiorycteropus* from Madagascar, which has long been considered a tubulidentate (Lamberton, 1946; MacInnes, 1956; Lavocat, 1958; Patterson, 1975, 1978; Thewissen, 1985; Asher et al., 2003). Due to its variety of ambiguous morphological features it has been assigned to its own order, Bibymalagasia (MacPhee, 1994). Recently, molecular sequence data for bone type I collagen of the subfossil consistently places *Plesiorycteropus* within Afrotheria and groups the enigmatic mammal with the tenrecs, not the aardvark (Buckley, 2013).

There are also the fossils of the Ptolemaiidae: *Ptolemaia*, *Qarunavus*, and *Cleopatrodon* from the late Eocene of Egypt (Osborn, 1908; Simons, 2005) and *Kelba* from the early Miocene of East Africa (Cote et al., 2007). Some analyses have placed them as pantolestids (Van Valen, 1966; Bown & Simons, 1987) or Carnivora (McKenna & Bell, 1997), but other research has suggested that ptolemaiids might be related to the aardvark (Simons & Gingerich, 1974; Simons & Bown, 1995; Cote et al., 2007; Seiffert, 2007; Gheerbrant et al., 2014). While these fossils have the potential to help elucidate the evolutionary history of *Orycteropus*, there is not enough material at this time to adequately analyze and draw firm conclusions.

A recent description of the fossil *Ocepeia* from the middle-Paleocene of Morocco interprets the genus as a stem paenungulate, but it most often falls with *Ptolemaia*, *Orycteropus*, and *Potamogale* in phylogenetic analysis. The authors suggest that *Ocepeia* is "the first known fossil link between insectivore-like and ungulate-like afrotherians" (Gheerbrant et al., 2014: 27). *Ocepeia* is thus of great interest to the study of the evolutionary relationships of *Orycteropus*.

Finally, members of the Meridungulata, the endemic South American ungulates, have also been suggested to be related to afrotheres. This association is based on some of the morphological characters proposed as synapomorphies of Afrotheria (Agnolin & Chimento, 2011; O'Leary et al., 2013). This association needs further study.

Aardvark myology and use of myological data in phylogenetic analysis

Thus, despite over a century of research on the systematic placement of the aardvark, it seems unable to be clearly resolved with the available data. My research has focused on the forelimb myology of the aardvark and other mammals as an alternative dataset with the potential to elucidate aardvark evolutionary relationships.

From the history of hypotheses of aardvark relationships summarized above, it is obvious that several studies of aardvark anatomy have been published (Cuvier & Laurillard, 1850; Humphry, 1868; Galton, 1870; Windle & Parsons, 1899a, 1899b; Sonntag, 1925; Sonntag & Wollard, 1925; Le Gros Clark & Sonntag, 1926; Frechkop, 1937; Thewissen & Badoux, 1986; Endo et al., 2002). Much of the early work, however, compared the aardvark with other "edentates" or only paenungulates. While not necessarily helpful in evaluating modern hypotheses of relationships, what was written demonstrated that special features of musculature can unite groups of mammals. For example, Le Gros Clark & Sonntag (1926: 483) concluded that, in myology, the aardvark "is closest to the Hyracoidea and Proboscidea, less close to the Perissodactyla, and most remote from the Artiodactyla" as "many of the resemblances between Artiodactyla and *Orycteropus* consist of generalized features present only in *Sus* and *Hippopotamus*."

Unfortunately, the most recent descriptions of aardvark forelimb myology are vague and incomplete and provide little or no comparative or phylogenetic information (Thewissen & Badoux, 1986; Endo et al., 2002).

Only a few published phylogenies have used extensive soft tissue characters, but these show that myological data can be valuable - perhaps even better than osteological data - in assessing relationships in vertebrates (Diogo, 2004, 2007). Characters collected from limb myology were used to help interpret the phylogeny of rodent groups (Stein, 1986, 1987, 1990, 1993). Features from the musculature of the Talpidae were used to construct a single most parsimonious cladogram and also demonstrate the robusticity of the technique (Whidden, 2000). Phylogenies of primates constructed using soft tissue characters agree with the molecular phylogeny rather than the phylogeny derived from skeletal morphology (Gibbs et al., 2002; Diogo & Wood, 2011, 2012). Another phylogenetic analysis using only 12 characters of the limb myology of two eulipotyphlans and two tenrecs, merely concluded that "myological characters seem to have a systematic value" and the number of species and characters considered should be increased (Neveu & Gasc, 2002: 200). These studies all employed soft tissue characters to analyze the relationships of similarly adapted mammals or a single mammalian order.

There are a few more broadly interordinal myological analyses pertinent to the evolutionary relationships of the aardvark. Before Afrotheria was proposed, myological traits were used to link Hyracoidea with Proboscidea and Sirenia and to reject a relationship with Perissodactyla (Shoshani, 1993). A study of snout musculature shows that the hyrax and aardvark are similar in having only two extrinsic snout muscles going into the snout tip, whereas the Afrosoricida (Tenrecidae and Chrysochloridae) share with eulipotyphlans a unique pattern of five snout muscles. Overall snout muscle morphology is thus consistent with an Afrotheria that includes only Hyracoidea, Macroscelidea, Proboscidea, Sirenia, and Tubulidentata (Whidden, 2002). Recently, an extensive character matrix including myological characters pulled from the literature was published to help elucidate placental mammal interrelationships at the Cretaceous-Paleogene boundary (O'Leary et al., 2013). Although many of their muscle characters are missing or unreliable based on my own dissections, they do find a myological synapomorphy for Afrotheria: the insertion of m. zygomaticus entirely on the external nares.

All these studies suggest that myological characters have the potential to contribute valuable information to phylogenetic analyses. In fact, including soft tissue characters for such analyses may eliminate potential biases inherent in many character-based analyses. Pilbeam (2000: 10686) stated that "soft tissues… are easy to describe relatively objectively. Most of the characters are discrete and natural morphogenetic units. Epigenetic effects are minimal and will not affect the number of muscle bellies… origins and insertions of muscles tend to be conservative; muscle gross morphology and relations are conserved regardless of evolutionary changes in hard tissue." Thus, a comprehensive database of reliable and accurate muscle characters for use in phylogenetic analysis would be beneficial for mammalian systematics.

Considering the myological similarities between the aardvark and other paenungulate taxa noted above, new documentation particularly of aardvark forelimb anatomy together with that of appropriate comparative taxa from the Afrotheria and Artiodactyla is highly relevant to resolving its relationships. In this era of molecular sequencing, conventional methods such as anatomical dissection can still provide valuable data and contribute to the debate over the phylogeny of Mammalia.

Summary of the dissertation

The difficulties of myological research have resulted in this important aspect of anatomy being relatively ignored, even though myology has been shown to have potential to help resolve mammalian relationships (Le Gros Clark & Sonntag, 1926; Stein, 1986, 1987, 1990, 1993; Shoshani, 1993; Shoshani & McKenna, 1998; Pilbeam, 2000; Gibbs et al., 2002; Neveu & Gasc, 2002; Whidden, 2002; Diogo & Wood, 2011, 2012; O'Leary et al., 2013). Therefore, for my dissertation project I proposed to employ anatomical dissection to clarify the forelimb myology of the aardvark, a variety of small afrotheres, and two artiodactyls (Table 1). Most of the species selected for dissection have scant anatomical information available and thus a new database of morphological information will be available for these animals.

It was also necessary to understand the forelimb anatomy of the many mammalian species I was not able to dissect myself, so previously published myological descriptions of most other orders of mammals were compared with my myological data. I identified unique and shared muscle characters that might have potential to help resolve the interordinal placement of Tubulidentata and other afrotheres. This new compilation of comparative anatomical data based on modern dissections rather than the century-old literature complements the array of molecular, dental, and osteological characters so widely available in online databases (Asher, 2007; O'Leary & Kaufman, 2012). It is my hope that these myological data, muscle attachment maps, photographs, and drawings be considered an original contribution to the fields of mammalian anatomy and evolution.

Clade	Order	Taxon	Common name	Sex	Location	Year	Condition	Museum	Specimen
Afrotheria	Tubulidentata	*Orycteropus afer*	Aardvark	F	zoo - NZP	1969	excellent	NMNH	259324
		Orycteropus afer	Aardvark	M	zoo	1961	preservation issues	FMNH	57406
		Orycteropus afer	Aardvark	M	zoo - NZP	1969	skeletal	NMNH	359621
	Macroscelidea	*Elephantulus brachyrhynchus*	Short-snouted sengi	?	Angola	1925	excellent	AMNH	87026
		Elephantulus brachyrhynchus	Short-snouted sengi	?	zoo - NZP - Egypt/Sudan	1948	skeletal	NMNH	283463
		Petrodromus tetradactylus tordayi	Four-toed sengi	M	Zaire	1931	abdomen incised	AMNH	86936
		Petrodromus tetradactylus	Four-toed sengi	F	zoo - NZP - Kenya	1976	skeletal	NMNH	521009
		Rhynchocyon cirnei stuhlmanni	Checkered sengi	?	Zaire	1927	excellent	AMNH	82364
		Rhynchocyon cirnei	Checkered sengi	F	Zaire	1979	skeletal	NMNH	537657
	Hyracoidea	*Procavia capensis scioana*	Rock hyrax	M	Sudan	1927	excellent	AMNH	82304
		Procavia capensis	Rock hyrax	?	South Africa	?	skeletal	NMNH	A21099
		Heterohyrax brucei prittwitzi	Yellow-spotted rock hyrax	?	Tanzania	?	abdomen incised	NMNH	241587
		Heterohyrax brucei	Yellow-spotted rock hyrax	F	Mauritania	1967	skeletal	NMNH	402169
	Afrosoricida	*Calcochloris leucorhinus*	Congo golden mole	F	Congo	1941	excellent	AMNH	118829
		Calcochloris leucorhinus	Congo golden mole	?	Zaire	?	skeletal	NMNH	61686
		Potamogale velox	Giant otter shrew	F	Central African Republic	1956	excellent - pregnant!	AMNH	170171
		Potamogale velox	Giant otter shrew	F	Cameroon	1933	skeletal	NMNH	266897
		Microgale dobsoni	Dobson's shrew tenrec	?	Madagascar	1929	abdomen incised	AMNH	100850
		Microgale dobsoni	Dobson's shrew tenrec	?	Salton & Sargis, 2008	?	published images	?	?
Laurasiatheria	Artiodactyla	*Pecari tajacu*	Collared peccary	F	zoo - SDZ	?	juvenile, necropsied	NMNH	541438
		Pecari tajacu angulatus	Collared peccary	M	zoo - NZP	1927	skeletal	NMNH	251659
		Tragulus napu	Greater mouse-deer	F	zoo - NZP	1932	excellent	NMNH	258348
		Tragulus napu	Greater mouse-deer	M	Inodnesia	1903	skeletal	NMNH	A49692

Table 1. Skeletal and alcoholic specimens examined for this project

CHAPTER 2 – MATERIALS AND METHODS

Sample for Dissection, and its Rationale

The right forelimbs of a total of twelve ethanol-preserved mammals were dissected (Table 1). Dissection specimens were selected from the alcoholic collections of The Field Museum of Natural History, the American Museum of Natural History, and the National Museum of Natural History, with a preference for the potential for original anatomical descriptions and utility of comparison with the aardvark.

Ten specimens of the Afrotheria were dissected: two aardvarks, a male and a female, three afrosoricids, two hyracoids, and three elephant shrews. The aardvarks were both zoo specimens, and the male was very poorly preserved, but the two specimens were the only aardvarks available for dissection. The Congo golden mole, *Calcochloris leucorhinus*, was selected to represent Chrysochloridae as its anatomy has not been described before. Dobson's shrew tenrec, *Microgale dobsoni*, was selected to represent Tenrecidae as it has only been incompletely described (Dobson, 1882a, 1882b). Another tenrec, the semi-aquatic giant African water shrew, *Potamogale velox*, was selected because it is the only African tenrec and its anatomy is unusual and poorly known (Dobson, 1883; Jullien, 1967). The three elephant shrews, *Elephantulus brachyrhynchus*, *Petrodromus tetradactylus*, and *Rhynchocyon cirnei,* were selected because they represent the range of sizes found in Macroscelidea and their forelimb myology is described in only one reference (Jullien, 1967). Hyraxes were not readily available so the only two nearly adult sized specimens, which happened to be *Procavia capensis* and *Heterohyrax brucei*, were chosen. The anatomy of hyracoids is better known (Murie &

Mivart, 1865; Windle & Parsons, 1901; Fischer, 1992), but I wished to have a representative of the paenungulate clade.

The remaining two orders of Afrotheria consist of much larger-bodied species. It was not practical to dissect an elephant or a manatee without assistance, nor were there elephant specimens available for dissection during the formative stages of this research. Instead, the literature available on the anatomy of Proboscidea was consulted (Anderson, 1883; Miall & Greenwood, 1878a+b; Nielsen, 1965; Shindo & Mori, 1956b; Windle & Parsons, 1901), and the excellent descriptions and illustrations of sirenian anatomy (Domning 1977, 1978).

As the aardvark has been considered a basal ungulate, I also obtained two members of Artiodactyla for dissection. *Tragulus napu* was selected as there are no anatomical descriptions in English, and *Pecari tajacu*, because its anatomy is better known and could serve rather like a control specimen despite its juvenile size. To represent the Perissodactyla, a specimen of *Tapirus* was also obtained, but this specimen was unable to be dissected due to construction delays in the dissection laboratory at the Smithsonian Museum Support Center in Suitland, Maryland where the large specimen was housed. Instead, previous publications were referenced (Murie, 1871; Windle & Parsons, 1901; Campbell, 1936; Bressou, 1961).

In all cases, I wrote detailed and complete descriptions of the forelimb myology and produced many images to document their anatomy. Any discrepancies with previously published information are noted in the descriptions in Chapter 3.

Dissection Technique

Dissections took place in laboratories at The Field Museum of Natural History in Chicago, Illinois; The Center for Functional Anatomy and Evolution at Johns Hopkins School of Medicine in Baltimore, Maryland; The Museum Support Center at the National Museum of Natural History in Suitland, Maryland; and The Department of Anatomy at Geisel School of Medicine at Dartmouth in Hanover, New Hampshire. The larger specimens were dissected under a fume hood using standard dissection instruments, and the smallest specimens were dissected under a Zeiss Stemi 2000-C stereo microscope using more delicate instruments.

As the specimens were preserved with ethanol, drying of the tissue was an issue during dissection. Specimens were periodically soaked in water to restore elasticity to the tissues, but were stored each night in 70% ethanol. Proceeding regionally, each layer of muscles and nerves were cleaned of all fascia and debris, and well photographed. When each muscle was satisfactorily described and photographed, it was removed at both origin and insertion so that deeper structures could be observed. Thus the forelimb was reduced to bones during the process of dissection for this project.

Anatomical Description

The musculature of the limbs was described using standard planes as described in the Nomina Anatomica Veterinaria (2005) and depicted in Figure 2. To describe elements in the transverse plane, cranial and caudal apply to the neck and trunk and to the limbs proximal to the carpus or tarsus. The terms dorsal and palmar are used for the manus. Dorsal also refers to the side of the body with the vertebral column ("the back"), and ventral means the abdominal side of the body ("the belly"). Medial means toward the sagittal plane, and lateral means away from the sagittal plane. One exception to this rule is the medial border of the scapula, which I describe as the vertebral border to avoid confusion with the ventral (deep) surface of the scapula (Figure 3). Muscles may attach laterally (toward the glenoid or axilla) or medially (toward the dorsum of the animal) on the spine or vertebral border of the scapula. Proximal means towards the end of the limb attached to the body, and distal means toward the end of the limb terminating in digits. Muscles may also insert proximal or distal to other muscles or landmarks.

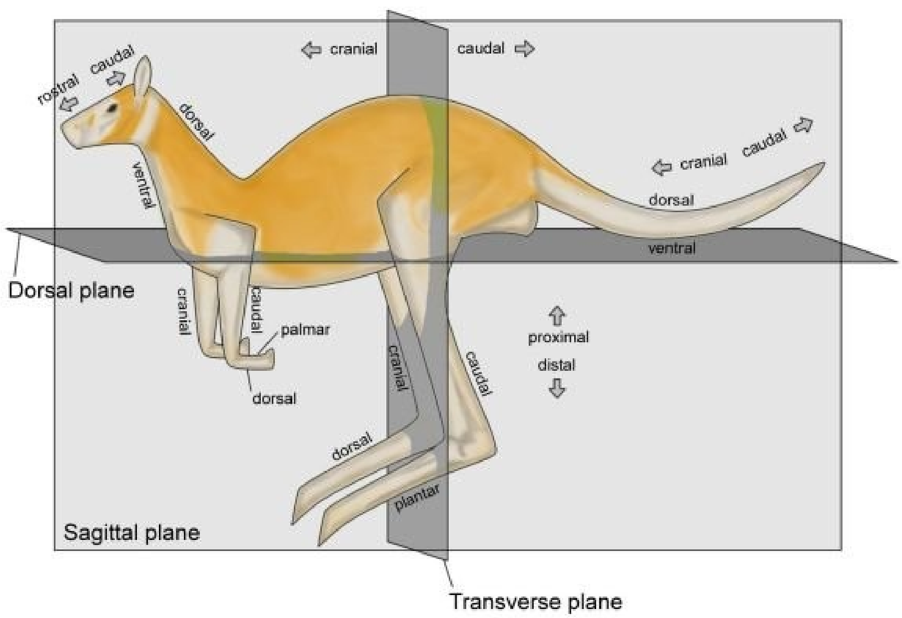


Figure 2.1. Planes of the body used in the muscle description.

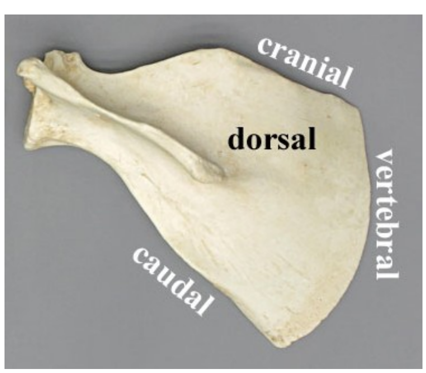


Figure 2.2. Left scapula of *Trichechus* showing borders of the scapula

During the dissections, general descriptions of the appearance of each muscle and its positional relationships to other muscles, nerves, and blood vessels were recorded in a notebook. This information was then combined with more detailed descriptions of the bony attachments as depicted in the muscle maps, resulting in stand-alone descriptions of the forelimb anatomy for each dissected species. These are presented in Chapter 3. Some of this material is repetitive given the generally similar structure of all mammals, but I felt it was important to give each dissected species full consideration rather than brief summaries.

Within the descriptions in Chapter 3, the muscles are grouped into sections because they are innervated by the same nerve or nerves, and/or share a basic common function, and/or may be prone to fusion and are easier to discuss together. Often, anatomists group muscles for convenience, but I tried to be mindful of these issues. The names of these groups were chosen by me and are not technical terms. Innervation of each muscle was recorded whenever possible, but the nerves were not always discernible. The basic pattern of innervation is typically assumed to be conserved within mammals, but further study of the embryological development of mammalian muscles and their nerve supply is much needed, as there are few studies of the forelimb complex or works trying to follow the modifications in the limb musculature within mammals (Haines, 1924; Howell, 1938; Romer, 1944; Cheng, 1955; Ellsworth, 1972). Innervations may be assumed to be typical unless otherwise noted in the species description.

Muscle Maps

To more clearly visualize the action of each muscle and compare functional anatomy among taxa, muscle maps depicting exactly where each muscle attaches onto the bones of the forelimb were created (as in Fisher et al., 2007). To create the muscle maps, a skeletal specimen was first photographed; the scapula and articulated manus in dorsal and ventral views, and the humerus, radius, and ulna in cranial, lateral, caudal, and medial views. The skeletal specimens used are listed in Table 1. The printed photographs and many of the skeletons were on hand during the dissections. After each muscle was cleaned and isolated, photographed, and described, it was carefully removed from its bony attachments with a scalpel. The maps were created in the laboratory by marking the areas of muscle attachment in permanent marker on a clear plastic sheet overlaying a bone photograph. For publication, the muscle markings were then digitally redrawn on the high resolution bone photographs using Adobe Photoshop Elements 8.0. The muscle maps accompany the text in Chapter 3, the descriptions of forelimb musculature.

Photographs and Illustrations

The dissections were documented with an initial CT scan of the specimen if possible, and as each dissection progressed many high resolution photographs were taken with an Olympus Camedia C-770 UltraZoom digital camera and/or the AxioCamERc5s camera attached to the Zeiss Stemi 2000-C stereo microscope. After each day of dissection the best photographs were printed and annotated so that a careful record of the anatomy was preserved. The digital photographs were edited and labeled in Adobe Photoshop Elements 8.0 before being placed to accompany the text in Chapter 3, the descriptions of forelimb musculature. The abbreviations used to label the muscles are listed in Appendix 1.

The sketch of the aardvark brachial plexus was drawn directly from the specimen. The trapezius complex illustrations in Appendix 4 were generally gleaned from the literature and altered using Adobe Photoshop Elements 8.0, although the illustrations of *Potamogale* and *Calcochloris* were created by tracing or combining the photographs of my dissections.

Anatomical literature and nomenclature

As this project requires muscle characters from all of the orders of mammals, a thorough study of the literature was required. It became clear during the initial stages of this research that the 150 years of anatomical literature cited herein is fraught with ambiguity. Muscles might merely be misidentified in an illustration, or two muscles described under the name of only one, or most commonly the error of omission, which leaves one to wonder whether the muscle was absent or simply not described. Sometimes muscles are figured but not described, or described but not figured. Inadequately preserved or necropsied specimens are also problematic, as not every muscle can be fully described, often leading to some confusion.

Additional confusion may stem from variation in muscle bellies or tendon position. Common myological, nervous, and arterial variants are well known for humans and some domestic animals, but these variations are virtually unknown for the more exotic species. Unfortunately, assessment of such variation in the latter is restricted by the limited availability of material for dissection. Discrepancies between my findings during dissection and the information in the literature are noted in the description of each specimen in Chapter 3.

Another issue with the literature involved determining muscle homologies across all mammals, which proved to be one of the most challenging aspects of this project. Information about innervation is usually not provided in published descriptions, and homologous muscles are given different names in different groups of animals or by different authors. To determine muscle homology and to standardize muscle names across different mammalian groups, I created a chart listing the name given each muscle, and a brief description of its attachments, for each original description I referenced in Chapter 4. This chart is found in Appendix 2. See also Table 2 for a quick reference to the nomenclature utilized in Chapters 3 and 4 compared with the nomenclature found in the Nomina Anatomica Veterinaria (2005) and the Terminologica Anatomica (1988). I followed the Nomina Anatomica Veterinaria (2005) when possible, but as it is based on domesticated, cursorial members of the orders Artiodactyla, Perissodactyla, and Carnivora, it is not always applicable to fossorial, arboreal, scansorial, flying, or aquatic mammals. Any deviations from the Nomina Anatomica Veterinaria (2005) are explained in Chapter 4.

Phylogenetic Framework

The analysis of the comparative anatomical literature was organized around the new phylogenetic framework of four clades of eutherian mammals: Afrotheria, Xenarthra, Laurasiatheria, Euarchontoglires (Waddell & Shelley, 2003; Springer et al., 2005; Asher et. al, 2009; Meredith et al., 2011), as depicted in Figure 1A. The characters discussed in Chapter 4 are shown on a current molecular phylogeny that was selected because it had a large number of taxa (Meredith et al., 2011).

	this thesis	Nomina Anatomica Veterinaria, 2005 domesticated mammals	Terminologica Anatomica, 1998 human anatomy
	BRACHIOCEPHALICUS	brachiocephalicus	-
ADM	ABD DIGITI MINIMI	abd digiti V	abd digiti minimi
APB	ABD POLLICIS BREVIS	abd digiti I brevis	abd pollicis brevis
APL	ABD POLLICIS LONGUS	abd digiti I longus	abd pollicis longus
	ARTICULARIS HUMERI	articularis humeri	-
TAC	TRICEPS BRACHII, ACCESSORY HEAD	triceps brachii caput accessorium	-
AD	ACROMIODELTOIDEUS	deltoideus pars acromialis	deltoideus pars acromialis
AT	ACROMIOTRAPEZIUS	trapezius pars cervicalis	trapezius pars descendens, pars transversa
A	ANCONEUS	anconeus	anconeus
BB	BICEPS BRACHII	biceps brachii	-
BBl	BICEPS BRACHII, long head	-	biceps brachii caput longum
BBs	BICEPS BRACHII, short head	-	biceps brachii caput breve
B	BRACHIALIS	brachialis	brachialis
BR	BRACHIORADIALIS	brachioradialis	brachioradialis
CD	CLAVODELTOIDEUS	brachiocephalicus - cleidobrachialis [pars clavicularis m. deltoidei]	deltoideus pars clavicularis
CT	CLAVOTRAPEZIUS	brachiocephalicus - cleidocephalicus pars occipitalis / cleidocephalicus pars cervicalis	-
CM	CLEIDOMASTOIDEUS	brachiocephalicus - cleidocephalicus pars mastoidea	sternocleidomastoideus
C	CONTRAHENTES	add digiti I, add digiti II, add digiti V	add pollicis
CB	CORACOBRACHIALIS	coracobrachialis	coracobrachialis
D-E	DORSO-EPITROCHLEARIS	tensor fascia antebrachii	-
E-A	EPITROCHLEO-ANCONEUS	-	-
	EXT BREVIS DIGITORUM	-	-
ECRb	EXT CARPI RADIALIS, brevis	ext carpi radialis brevis	extensor carpi radialis brevis
ECRl	EXT CARPI RADIALIS, longus	ext carpi radialis longus	extensor carpi radialis longus
ECU	EXT CARPI ULNARIS	ext carpi ulnaris [ulnaris lateralis]	ext carpi ulnaris
EDC	EXT DIGITORUM COMMUNIS	ext digitorum communis	ext digitorum
EDL	EXT DIGITORUM LATERALIS	ext digitorum lateralis	ext digiti minimi caput humerale, caput ulnare
EDP	EXT DIGITORUM PROFUNDUS	ext digiti I + ext digiti II	ext pollicis longus + ext indicis
	EXT POLLICIS BREVIS	-	ext pollicis brevis
I	FLX DIGITORUM BREVES PROFUNDUS	flx digiti I brevis, flx digiti II, flx digiti V, interossei	flx pollicis brevis, opponens pollicis, flx digiti minimi brevis, opponens digiti minimi, interossei dorsales, interossei palmares

Table 2. Abbreviations and terms used within this thesis compared with the Nomina Anatomica Veterinaria (2005) and the Terminologica Anatomica (1998).

	this thesis afrotheres & artiodactyls	Nomina Anatomica Veterinaria, 2005 domesticated mammals	Terminologica Anatomica, 1998 human anatomy
FBM	FLX DIGITORUM BREVIS MANUS	flx digitorum brevis	-
FCR	FLX CARPI RADIALIS	flx carpi radialis	flx carpi radialis
FCU	FLX CARPI ULNARIS	flx carpi ulnaris	flx carpi ulnaris
FDP	FLX DIGITORUM PROFUNDUS	flx digitorum profundus	flx digitorum profundus + flx pollicis longus
FDS	FLX DIGITORUM SUPERFICIALIS	flx digitorum [digitalis] superficialis	flx digitorum superficialis caput humeroulnare, caput radiale
IN	INFRASPINATUS	infraspinatus	infraspinatus
X	INTERFLEXORII	interflexorii	-
IT / D-C	INTERMEDIATE TRAPEZIUS / DORSO-CUTANEUS	-	-
	INTERMETACARPALES	-	-
LD	LATISSIMUS DORSI	latissimus dorsi	latissimus dorsi
L	LUMBRICALES	lumbricales	lumbricales
OH	OMOHYOIDEUS	omohyoideus	omohyoideus
OT	OMOTRANSVERSARIUS	omotransversarius	-
PB	PALMARIS BREVIS	-	palmaris brevis
PL	PALMARIS LONGUS	-	palmaris longus
PC	PANNICULUS CARNOSUS	cutaneus trunci	-
PA	PECTORALIS ABDOMINALIS	-	-
PP	PECTORALIS PROFUNDUS	pectoralis profundus [pectoralis ascendens]	pectoralis minor
PSc	PECTORALIS SUPERFICIALIS	-	pectoralis major pars clavicularis
PSs	PECTORALIS SUPERFICIALIS	pectorales superficiales - pectoralis descendens	pectoralis major pars sternocostalis
PSd	PECTORALIS SUPERFICIALIS	pectorales superficiales - pectoralis transversus	-
PQ	PRONATOR QUADRATUS	pronator quadratus	pronator quadratus
PT	PRONATOR TERES	pronator teres	pronator teres caput humerale, caput ulnare
*	RADIAL SESAMOID / "PRE-POLLUX" / vestigial MC1	-	-
RO	RHOMBOIDEUS CAPITIS	rhomboideus capitis	-
RC	RHOMBOIDEUS CERVICIS	rhomboideus cervicis	rhomboideus major
RT	RHOMBOIDEUS THORACIS	rhomboideus thoracis	rhomboideus minor
SVC	SERRATUS VENTRALIS CERVICIS	serratus ventralis cervicis	levator scapulae
SVT	SERRATUS VENTRALIS THORACIS	serratus ventralis thoracis	serratus anterior
SD	SPINODELTOIDEUS	deltoideus pars scapularis	deltoideus pars spinalis
ST	SPINOTRAPEZIUS	trapezius pars thoracica	trapezius pars ascendans

Table 2 continued. Abbreviations and terms used within this thesis compared with the Nomina Anatomica Veterinaria (2005) and the Terminologica Anatomica (1998).

	this thesis afrotheres & artiodactyls	Nomina Anatomica Veterinaria, 2005 domesticated mammals	Terminologica Anatomica, 1998 human anatomy
SF	STERNO-FACIALIS	-	-
SM	STERNOMASTOIDEUS	sternocephalicus pars mandibularis / pars mastoidea / pars occipitalis	sternocleidomastoideus
S-S	STERNOSCAPULARIS	-	-
SU	SUBCLAVIUS	subclavius	subclavius
SS	SUBSCAPULARIS	subscapularis	subscapularis
P	SUPINATOR	supinator	supinator
S	SUPRASPINATUS	supraspinatus	supraspinatus
TMA	TERES MAJOR	teres major	teres major
TMI	TERES MINOR	teres minor	teres minor
TLA	TRICEPS BRACHII CAPUT LATERALE	triceps brachii caput laterale	triceps brachii caput laterale
TLO	TRICEPS BRACHII CAPUT LONGUM	triceps brachii caput longum	triceps brachii caput longum
TME	TRICEPS BRACHII CAPUT MEDIALE	triceps brachii caput mediale	triceps brachii caput mediale
*	ULNAR SESAMOID	-	-
+	additional muscle in cranial arm	-	-

Table 2 continued. Abbreviations and terms used within this thesis compared with the Nomina Anatomica Veterinaria (2005) and the Terminologica Anatomica (1998).

Phylogenetic Analysis

The soft tissue characters were selected based on my descriptions and photographs of each muscle and from the muscle maps, and the same characters were culled from the literature for the genera listed in Appendix 2. Neveu and Gasc (2002: 200) stated that "myological characters have meaning only if the species considered do not present drastically different specializations." I found this to be true only for the extremes of mammalian locomotor adaptation: bats, whales, and moles. The diversity of mammals compared required that the forelimb myology characters were carefully considered, although this is not substantially different from the process of selecting characters for broad cranio-dental cladistic analysis. For example, I avoided comparing digits of insertion for the digital extensors and flexors, as I thought this would reflect only patterns of digit reduction. Instead, I focused on easily quantifiable patterns that emerged, such as the nine possible configurations of the two heads of origin and two heads of insertion of m. biceps brachii, or number of heads of m. flexor digitorum profundus originating from the humerus.

In addition, I hoped to minimize the problem of human error or muscle aberrations in the final analysis. I avoided any overly detailed differences in muscle attachments. For example, specific numbers of vertebral attachments of mm. trapezius or rhomboideus, which often differ even within species and may be due to human error. Whenever discrepancies in attachments arose for a particular muscle within a genus, preference was given to the more detailed anatomical descriptions or those with fine illustrations, or the character was scored as polymorphic until more data can be obtained. Occasionally, characters were clearly polymorphic within a family or order.

In a study of the impact of myological variation on cladistic hypotheses of arvicoline rodent relationships, Kesner (1994: 41) stated "the error and power of the… cladogram are more sensitive to reductions in character number than to the inclusion of an occasional incorrect character state." The error in these data cannot be estimated, but first-person dissections helped ease problems of muscle character identification stemming from literature analysis alone, as in the analysis of O'Leary et al. (2013) where often the characters of forelimb myology are missing or inaccurate for many species.

The 60 characters are described in Chapter 4 and the character matrix is found in Appendix 3. For each of the 46 orders or families considered, myological information for several species was combined to form the most complete picture possible of a mammal for each operational taxonomic unit. Typically the myology varies little within a family. See Appendix 2 for a compilation of the primary data for each species considered. It should be understood that while this compilation of data is a useful reference for future comparative anatomical researchers, many more species need to be dissected by modern anatomists to improve the quality of the data. Mesquite version 2.75 (Maddison & Maddison, 2011) was used to perform three analyses of the data, which are discussed in Chapters 4 and 5.

Ancestral character state analysis: all Mammalia

Chapter 4 reviews the 60 characters of mammalian forelimb myology which I have scored for most of the orders of mammals. The data matrix is found in Appendix 3. Each character was optimized onto a previously published molecular phylogeny of mammals (Waddell & Shelley, 2003 figure 10) by using the trace character history function in Mesquite 2.75 (Maddison & Maddison, 2011). This parsimony reconstruction method finds the ancestral states to minimize the number of steps of character change given the tree and character data matrix. It was assumed that the character states are unordered, and one step is counted for any change (Maddison & Maddison, 2011). Thus, the most parsimonius ancestral state is recreated for each of the 60 characters, and I discuss which characters of forelimb myology seem to reflect phylogeny, and which reflect functional anatomy.

Parsimony analysis 1: all Mammalia

The first phylogenetic analysis, discussed in Chapter 5, again involved the 60 characters of forelimb myology identified for most of the orders of mammals. I ran a Mesquite heuristic search to minimize tree length using the character matrix. The parsimony model was subtree pruning and regrafting (SPR), which removes all possible subtrees from the main phylogeny and reinserts them at all possible locations (Maddison

& Maddison, 2011; Varvio, 2011). When the arranging of one tree is finished, another tree begins the branch-swapping algorithm. Whenever a tree rearrangement results in a shorter tree the current trees are deleted and the analysis begins again with the new shortest tree (Varvio, 2011). I set a maximum of 200 equally most-parsimonious trees; 178 were returned.

First, a strict consensus tree was calculated, but this was uninformative, as no clades were present in all 178 trees. Second, a 50% majority rules consensus tree, which depicts those clades found in at least 50% of the 178 most-parsimonious trees, was used to discuss the preliminary phylogeny of Mammalia indicated by the 60 characters of forelimb myology.

Parsimony analysis 2: Afrotheria only

A second parsimony analysis, also discussed in Chapter 5, of the 60 character matrix for the seven orders comprising Stanhope et al.'s (1998) Afrotheria, Monotremata, Marsupialia, and Euarchontoglires as outgroups. I ran a Mesquite heuristic search to minimize tree value using the character matrix, which recovered 23 equally parsimonious trees. A 50% majority rules consensus tree of all 23 trees shows the phylogeny of Afrotheria indicated by the 60 characters of forelimb myology. This phylogeny was used to discuss where characters of forelimb myology place the aardvark within Afrotheria, and possible myological synapomorphies uniting clades Afroinsectiphilia, Paenungulata, and Afrotheria.

CHAPTER 3 – DESCRIPTIONS OF FORELIMB MYOLOGY

3. 1 - Tubulidentata – Orycteropodidae - *Orycteropus afer*

Published accounts of aardvark dissections are rare. Cuvier & Laurillard (1850) provided nine figures but no descriptions. Humphry (1868) gave a fairly complete accounting of the forelimb myology, but compared *Orycteropus* with the harbor seal, *Phoca*. His illustrations are superficial and his now-archaic terminology is often difficult to relate to current anatomical terminology. Galton (1870: 568) described the myology of a large male aardvark, but noted "I must here crave indulgence for a looseness and seeming uncertainty in my descriptions of certain muscles, seeing that I had no skeleton at manus while dissecting." He often compared *Orycteropus* with *Myrmecophaga* and provides several illustrations of *Orycteropus* in what are now considered unorthodox orientations. Windle & Parsons (1899) did not dissect an aardvark themselves, but summarized the anatomy of *Orycteropus* and compare it with many members of the polyphyletic order "Edentata," particularly the modern orders Pholidota and Xenarthra. Shrivastava (1962c) dissected only the m. deltoideus and compared *Orycteropus* with the Pholidota and Xenarthra, but provided no figures of *Orycteropus*. Sonntag (1925) gave a thorough and reasonably modern treatment of the myology of *Orycteropus*, but again the animal is compared with members of the "Edentata" as was convention at the time. There are a few informative illustrations of the head, but most of the other drawings are confusing and show only a small portion of the anatomy. Thewissen & Badoux (1986) provided brief descriptions of a small number of the forelimb muscles and also provide some muscle maps and a few line drawings that do not always agree with my observations. They briefly compare *Orycteropus* with other fossorial mammals of the orders Xenarthra, Pholidota, and the Chrysochloridae. Endo et al. (2002) provided brief mention of some of the forelimb muscles and their functions, and a few nice photographs of the extensor and flexor muscles at the wrist. I do not agree with some of their muscle identifications, and in fact they mentioned "the anatomical nomenclature has not been fixed at least in the forearm muscle in *Orycteropus*" (Endo et al., 2002: 125).

The following descriptions are based upon dissections of two adult aardvarks, a male and a female, both zoo animals. Muscle attachments are referenced to and mapped on photographs of an adult male skeleton. All photographs are of the female specimen due to preservation issues with the male specimen, and the final descriptions are based on the dissection of the better condition female specimen whenever discrepancy arose. See Table 1 for specimen information.

A. 

Figure 3.1-1. Pre-dissection photographs of *Orycteropus afer*, NMNH 259324.

A. Lateral (PA 020081)

B. 

C.

Figure 3.1-1 continued. Pre-dissection photographs of *Orycteropus afer,* NMNH 259324.

B. Ventral (PA020088). C. Cranial (PA020079)

BRACHIAL PLEXUS

The brachial plexus of *Orycteropus* specimen NMNH 259324 is similar to that depicted by Sonntag & Wollard (1925). Although tracing of all the nerves to their roots was difficult due to dissection limitations imposed by the museums, the brachial plexus was made up of contributions from C5-T1 (Sonntag & Wollard, 1925). Compared with humans, there are fewer nerve roots contributing to each terminal nerve in the aardvark.

The suprascapular, rhomboideus, and long thoracic nerves are derived from C5 and are not depicted here due to the way the plexus was cut during removal of the forelimb. These nerves supplied the mm. supraspinatus, infraspinatus, rhomboideus, and serratus ventralis as usual.

The musculocutaneous nerve is derived from the anterior divisions of C6-7, and supplies the mm. coracobrachialis, biceps brachii, and brachialis as usual. It does not provide cutaneous innervation to the forearm as in humans (Standring et al., 2005); this is accomplished by the radial nerve.

The two subscapular nerves and nerve for teres major are derived from the posterior divisions of C6-7, as is the large axillary nerve which supplies m. teres minor before diving into the quadrangular space with the posterior circumflex humeral artery to supply the mm. deltoideus and teres minor. Unlike Sonntag & Wollard (1925), I did not observe axillary nerve innervation to mm. brachioradialis and triceps brachii caput laterale.

The posterior division of C7 also forms the thoracodorsal nerve, which innervates m. latissimus dorsi as usual, and contributes to the large radial nerve, which also receives contributions from C8-T1. The radial nerve innervates mm. dorso-epitrochlearis, triceps brachii, brachioradialis, and all the extensors, and provides sensory innervation to the dorsum of the carpus and manus.

To the trunk of the median and ulnar nerves I observed contributions from C7-T1, however the C7 contribution was from the anterior division rather than the posterior division as observed by Sonntag & Wollard (1925). The median nerve passes through the entepicondylar foramen of the humerus with the brachial artery to innervate mm. pronator teres, flexor carpi radialis, palmaris longus, flexor digitorum profundus, pronator quadratus, and lumbricales. It also provides sensory innervation to digits II-IV and possibly V, and communicates with the ulnar nerve at the base of digit IV. The ulnar nerve supplies mm. epitrochleo-anconeus, flexor digitorum profundus, flexor carpi ulnaris, contrahentes, flexor digitorum breves profundus. It also provides sensory innervation to digits IV-V in connection with the median nerve.

The pectoral nerves, not mentioned by Sonntag & Wollard (1925), seem to have contributions from the anterior division of all the nerves and are more substantial than the pectoral nerves in humans. The nerve for m. pectoralis superficialis has more fibers from the more proximal cervical nerves, while the nerves for mm. pectoralis profundus, pectoralis abdominalis, and panniculus carnosus have more fibers from the caudal cervical and first thoracic nerves. The fused mm. panniculus carnosus and latissimus dorsi split around the brachial plexus and axillary vessels, with m. latissimus dorsi passing deep and m. panniculus carnosus passing superficial to the neurovascular bundle.

Further details regarding the location of the nerves of the brachial plexus in relation to the muscles of the forelimb are found in the text. of each section A-M.

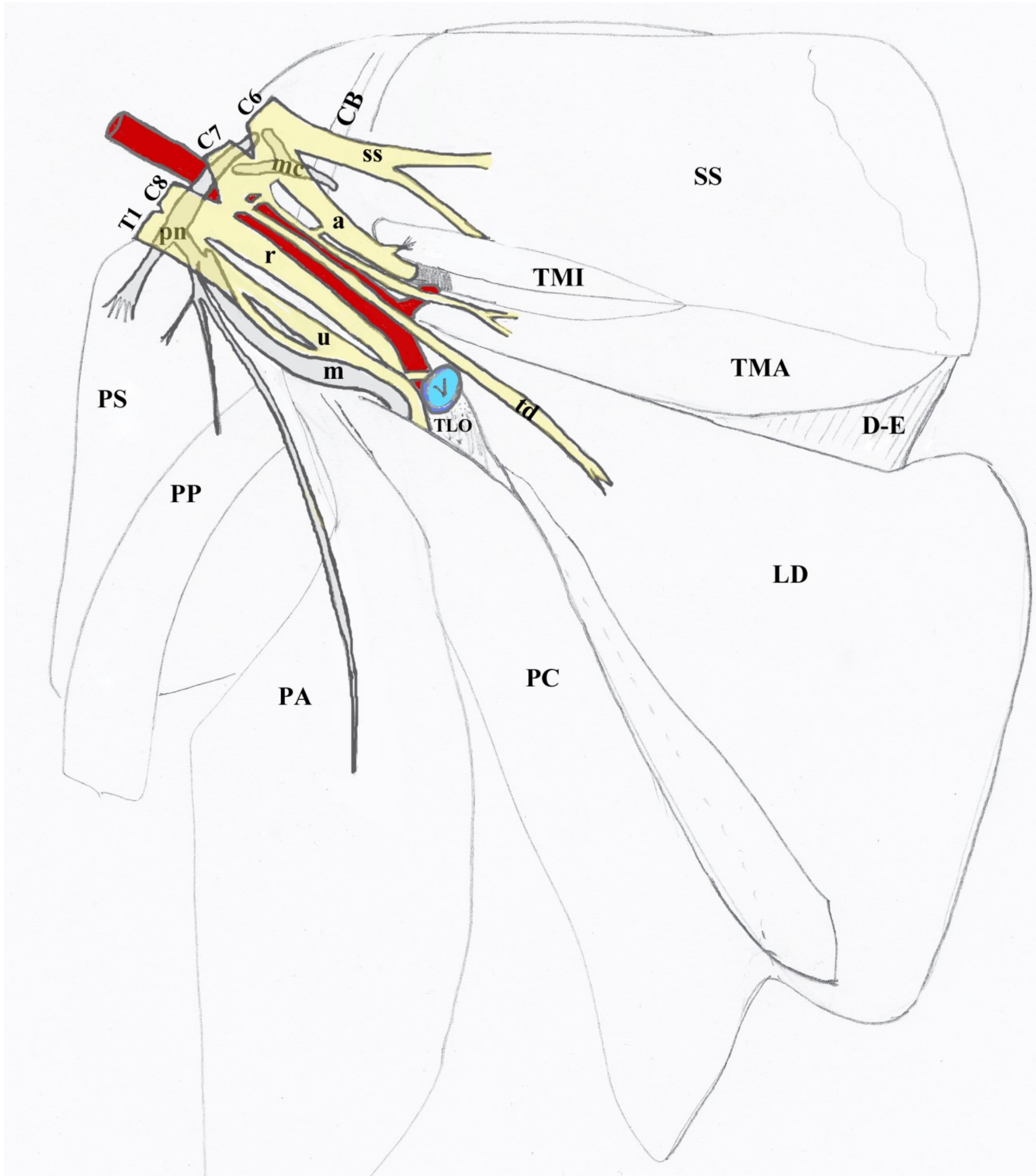


Figure 3.1-2. Brachial plexus, cut and reflected laterally. C5 nerves not depicted.

[a- axillary nerve, C6-8- cervical nerve roots, CB- coracobrachialis, D-E- dorso-epitrochlearis, LD- latissimus dorsi, m- median nerve, mc- musculocutaneous nerve, PA- pectoralis abdominalis, PC- panniculus carnosus, pn- pectoral nerve, PP- pectoralis profundus, PS- pectoralis superficialis, r- radial nerve, ss- subscapular nerve, T1- thoracic nerve root, td- thoracodorsal nerve, TLO- triceps brachii caput longum, TMA- teres major, TMI- teres minor, u- ulnar nerve, v- brachial vein]

0. CUTANEOUS MUSCULATURE

mm. sternofacialis (= cutaneous ventralis?), dermo-humeralis (= sphincter colli?)

"M. sternofacialis" of Sonntag (1925) may correspond to the muscle known as m. cutaneous ventralis, but as the terminology for the cutaneous musculature is not certain I have retained the original term here. It inserts for 15 cm along the sternum, superficial to the other muscles attached to the sternum. The cephalic vein travels deep to its lateral edge to join with the axillary vein.

"M. dermo-humeralis" of Sonntag (1925) may correspond to m. sphincter colli of other mammals, but again I have simply retained the original term used for *Orycteropus*. Alternatively, the muscle may be m. sternalis (Galton, 1870) or merely a differentiated portion of m. panniculus carnosus (Sonntag, 1925). It originates from the superficial face which was not dissected. Its muscle fibers are parallel to those of m. omotransversarius and m. acromiotrapezius, but sweep down the arm. Over the proximal radius, it thins to end as fatty tissue that connects with the layer of thick shiny fascia which encases the entire forearm and manus. It is also connected dorsally with the thicker fascia over the spine of scapula which marks the insertion of m. acromiotrapezius. A branch of the axillary nerve emerges from between portions of the m. deltoideus and enters the deep surface of m. "dermo-humeralis," possibly homologous to the small portion of the axillary nerve which innervates the skin of the shoulder in humans. Galton (1870) described this muscle originating from the jugal arch and inserting into the radial edge of the forearm and refered to Cuvier & Laurillard's (1850) name "dermo-humerien."

Figure 3.1-3. Skinned aardvark showing cutaneous musculature (PA220119).
Note connections between mm. latissimus dorsi [LD] and panniculus carnosus [PC].

A. TRAPEZIUS GROUP – ACCESSORY NERVE and CERVICAL NERVES

mm. sternomastoideus, cleidomastoideus, clavotrapezius, acromiotrapezius, spinotrapezius, dorsocutaneous

M. sternomastoideus originates with m. cleidomastoideus from the paroccipital and mastoid processes via several slips of muscle, then separates from m. cleidomastoideus and travels deep to the very large submandibular gland. M. clavotrapezius joins the caudolateral edge of the muscle, and then m. sternomastoideus fuses briefly with its compatriot to insert into the manubrium in connection with m. clavotrapezius.

M. cleidomastoideus is smaller than m. sternomastoideus and the external jugular vein runs along its caudolateral edge before crossing deep to m. clavotrapezius. It inserts into the medial clavicle.

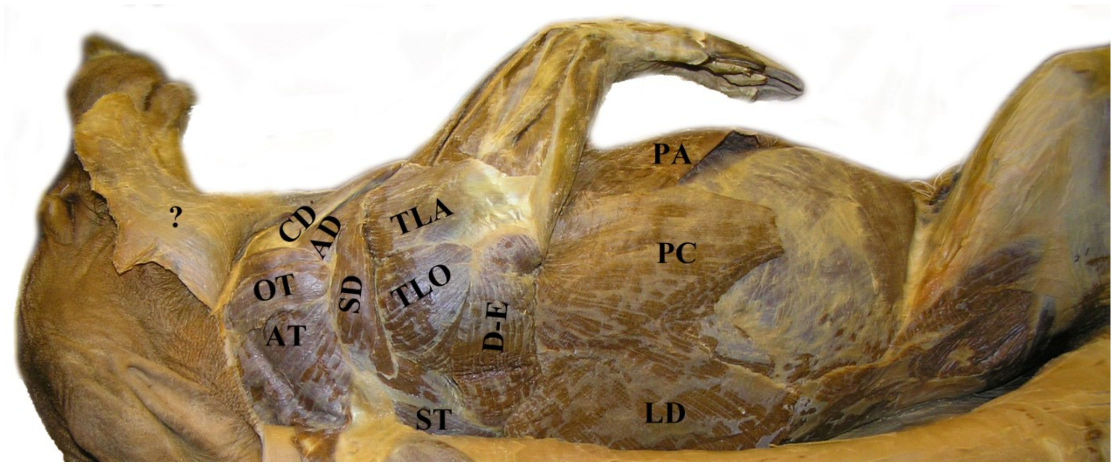
M. clavotrapezius is described as absent in *Orycteropus*, and Humphry (1868), Galton (1870), and Sonntag (1925) all noted there is no attachment to the clavicle by the trapezius. However, I believe the "depressor auris" muscle of Galton (1870), the "depressor" of Humphry (1868), and the "depressor auriculae" which Sonntag (1925: 24) described as "a separated piece of the sterno-mastoid" may represent m. clavotrapezius. This muscle originates from the base of the pinna where it is fused with the auricular muscles. At its origin it is separated from m. sternomastoideus by the external jugular vein, but then fuses with the caudolateral edge of m. sternomastoideus distally and inserts onto the manubrium in connection with m. sternomastoideus. This is a less obvious and discrete m. clavotrapezius than is found in most mammals, but is quite similar to the strange m. cleidomastoideus in *Potamogale*. It is possible that this muscle actually represents m. cleidomastoideus, which inserts on the manubrium in many other afrotheres according to my interpretation of the trapezius complex (Miall & Greenwood, 1878; Dobson, 1882, 1883; Windle & Parsons, 1901; Shindo & Mori, 1956b; Verheyen, 1961; Jullien, 1967; Domning, 1977, 1978). The great auricular nerve emerges from just distal to m. clavotrapezius, separating the muscle from m. acromiotrapezius.

The remaining dorsal portions of the trapezius complex are joined into a robust, triangular sheet of muscle that stretches from the skull to the mid-thoracic region and covers the shoulder. However, the division between mm. acromiotrapezius and spinotrapezius is still evident. There is a gap in the fleshy origin of the muscle between the portion of the muscle originating from the cranium and ligamentum nuchae, and the portion of the muscle originating from the thoracic vertebrae. Fascia fills in this hole, and connects the fleshy fibers there to the dorsum of the animal.

The leading edge of m. acromiotrapezius is covered by a cutaneous muscle, the “dermo-humeralis” (Sonntag, 1925). Reflecting it reveals that m. acromiotrapezius originates from the occiput and the ligamentum nuchae, and its cranial edge is closely applied to and even merged with the m. omotransversarius. M. acromiotrapezius inserts onto the acromion deep to the insertion of m. omotransversarius, the glenoid half of the scapular spine, and the large oval tendon of insertion of m. spinotrapezius. That portion inserting on the tendon of m. spinotrapezius, however, may be in reality the remnant of a m. dorsocutaneous or an “intermediate trapezius” similar to that found in the macroscelidids (Jullien, 1967). Otherwise the m. dorsocutaneous is absent.

M. spinotrapezius originates from the spinous processes of T1-T9 and inserts via a broad oval tendon onto a widening of the scapular spine near its midpoint. Cranial to the tendon of insertion are the fleshy fibers conjoining mm. spinotrapezius and acromiotrapezius; these fibers may represent an “intermediate trapezius.” M. spinotrapezius is very thick as it nears its insertion on the scapula and thins dorsally, where it overlaps and then merges on its deep surface with m. latissimus dorsi. The fleshy bellies of both mm. spinotrapezius and latissimus dorsi terminate in the lower thorax and share the thickened white sheet of thoracolumbar fascia. This fascial sheet is extremely powerful and would strongly anchor these two muscles to the dorsal surface of the animal.

A.



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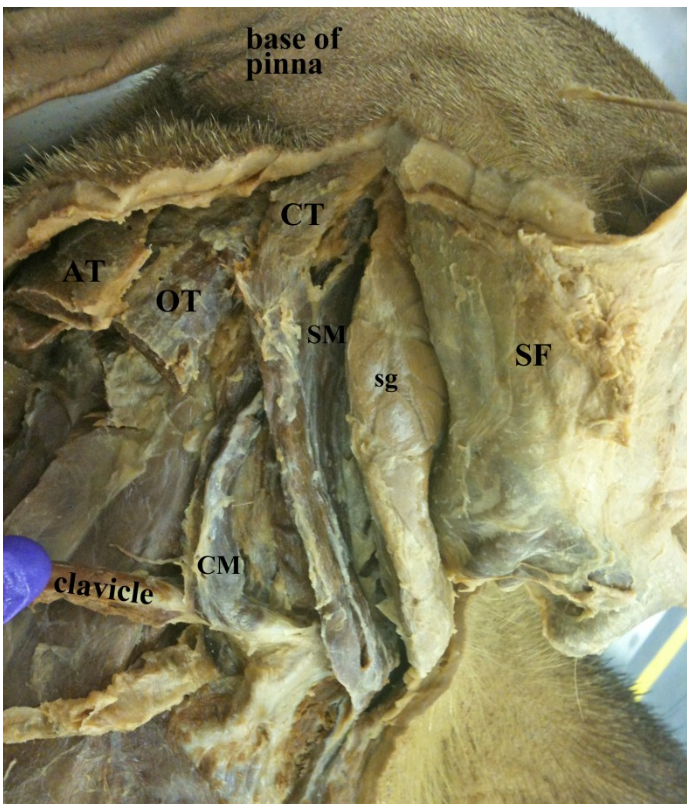
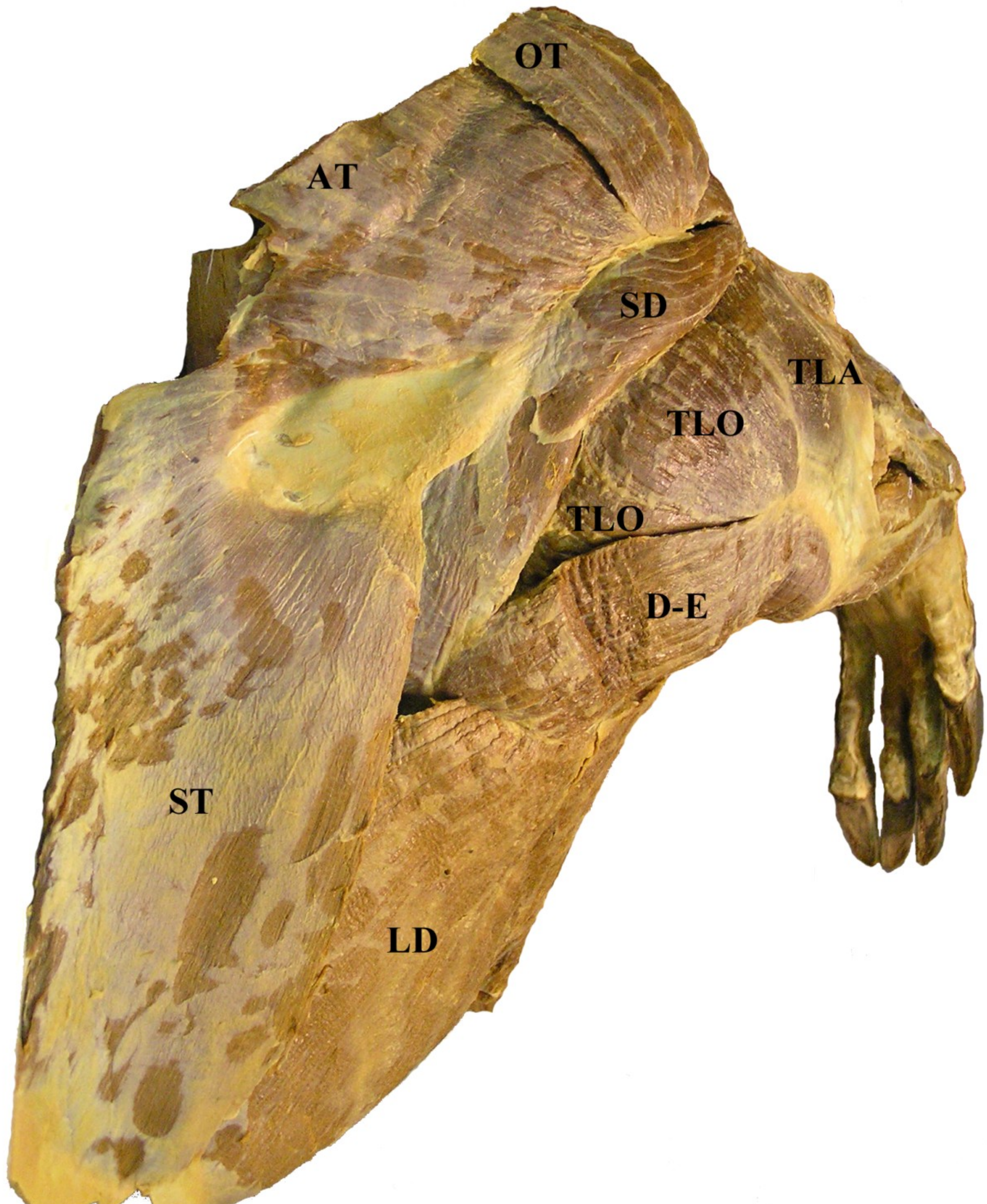


Figure 3.1-4. Trapezius complex.

A. Lateral view (P3270036). B. Ventral view (892).

[?- sternofacialis, AT- acromiotrapezius, CD- clavodeltoideus, CM- cleidomastoideus, CT- clavotrapezius, D-E- dorso-epitrochlearis, LD- latissimus dorsi, OT- omotransversarius, PA- pectoralis abdominalis, PC- panniculus carnosus, SD- spinodeltoideus, SF- sternofacialis, sg- salivary gland, SM- sternomastoideus, ST- spinotrapezius, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum]



C.

Figure 3.1-3 continued. Trapezius complex.
C. Dorsal view, forelimb removed (P4070044).

[AT- acromiotrapezius, D-E- dorso-epitrochlearis, LD- latissimus dorsi, OT- omotransversarius, SD- spinodeltoideus, ST- spinotrapezius, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum]

B. RHOMBOID GROUP – DORSAL SCAPULAR NERVE

mm. rhomboideus capitis, rhomboideus cervicis, rhomboideus thoracis

The rhomboids in *Orycteropus* have previously been reported as fused into one sheet, but there is an additional "occipito-scapular" portion I believe represents the rhomboideus capitis (Galton, 1868; Sonntag, 1925). While connected, I observed three divisions as follows. Humphry (1868) also described three divisions.

M. rhomboideus capitis originates from the first and second cervical vertebrae. It is 3.5 cm wide when it becomes visible and it widens to 5.5 cm at its insertion into the fascia covering m. supraspinatus. The insertion begins at the same level as the tuber on the scapular spine and about 2 cm from the cranial border of the scapula, and angles toward the cranial angle of the scapula. At that corner, it fuses with the edge of m. rhomboideus cervicis for 1.7 cm. Their shiny fascia is also joined, and this spreads in a sheet along the entire vertebral border of the scapula. This portion was described under the term "occipito-scapularis" by Sonntag (1925), and also by Galton (1870), who believed it to be either an "occipitoscapular" as he had described in *Dasypus* or a small portion of m. serratus ventralis cervicis. Thewissen & Badoux (1986) described this muscle together with m. serratus ventralis cervicis. Originally I believed this muscle to be a second portion of m. omotransversarius due to its cervical vertebrae origin, similar to the second poriton of m. omotransversarius seen in chrysochlorids and hyracoids. However, its insertion on the superficial surface of the scapula is similar to m. rhomboideus capitis in tenrecs and chrysochlorids. Thus homology here is not certain.

M. rhomboideus cervicis originates from the occiput and ligamentum nuchae. Along the neck the muscle is thicker, about 1 cm thick and 3 cm wide. The fibers are at an acute angle as they head toward insertion on the superficial and deep surfaces of the cranial angle of the scapula and along the cranial end of the vertebral border.

At its origin, the different fiber direction of m. rhomboideus thoracis makes it clearly distinct from m. rhomboideus cervicis. The muscle originates from the spinous processes of the first four thoracic vertebrae. The fibers of m. rhomboideus thoracis merge somewhat with m. rhomboideus cervicis, and it inserts along the superficial and deep surfaces of the vertebral border. Its insertion is particularly robust near the caudal angle of the scapula.

D-E- dorso-epitrochlearis
LD- latissimus dorsi
OT- omotransversarius
RC- rhomboideus cervicis
RO- rhomboideus capitis
RT- rhomboideus thoracis
S-S- sternoscapularis
SD- spinodeltoideus
ST- spinotrapezius
TLA- triceps brachii caput laterale
TLO- triceps brachii caput longum
TMI- teres minor

Figure 3.1-5. Mm. rhomboideus, dorsal view (P4090013).

C. OMO GROUP – CERVICAL NERVES, LONG THORACIC NERVE

mm. omotransversarius, omohyoideus, serratus ventralis (cervicis, thoracis)

M. omotransversarius originates from the transverse process of the atlas. It covers the cranial edge of m. acromiotrapezius, inserting superficial to and partially fused with that muscle on the acromion and the surrounding fascia. The muscle is figured in Sonntag (1925) but not described; Sonntag (1925) erroneously referred to the omotransversarius muscle as the retractor auris in his description of trapezius. Humphry (1868) described it as the "cervico-humeral."

M. omohyoideus is absent, which agrees with Galton (1870) and Sonntag (1925). The muscle is not mentioned by Humphry (1868) or Thewissen & Badoux (1986).

M. serratus ventralis cervicis originates from the transverse processes of the 2-5th cervical vertebrae and inserts over 12 mm on the cranial angle and edge of the scapula via some robust tendinous fibers. It also inserts on the deep surface of the scapula in connection with m. serratus ventralis thoracis. Thewissen & Badoux (1986) also described an origin also from the transverse process of the atlas, but I believe that origin more accurately belongs to m. rhomboideus capitis.

M. serratus ventralis thoracis originates from the proximal 8 ribs and its insertion spans 6 cm on the deep surface of the scapula, curving between the insertions of mm. rhomboideus and subscapularis. At insertion there is a slight division between the fibers corresponding to m. serratus ventralis cervicis and those corresponding to m. serratus ventralis thoracis but the muscles quickly fuse up and are indistinguishable. Mm. serratus ventralis are quite powerful protractors and rotators of the scapula.

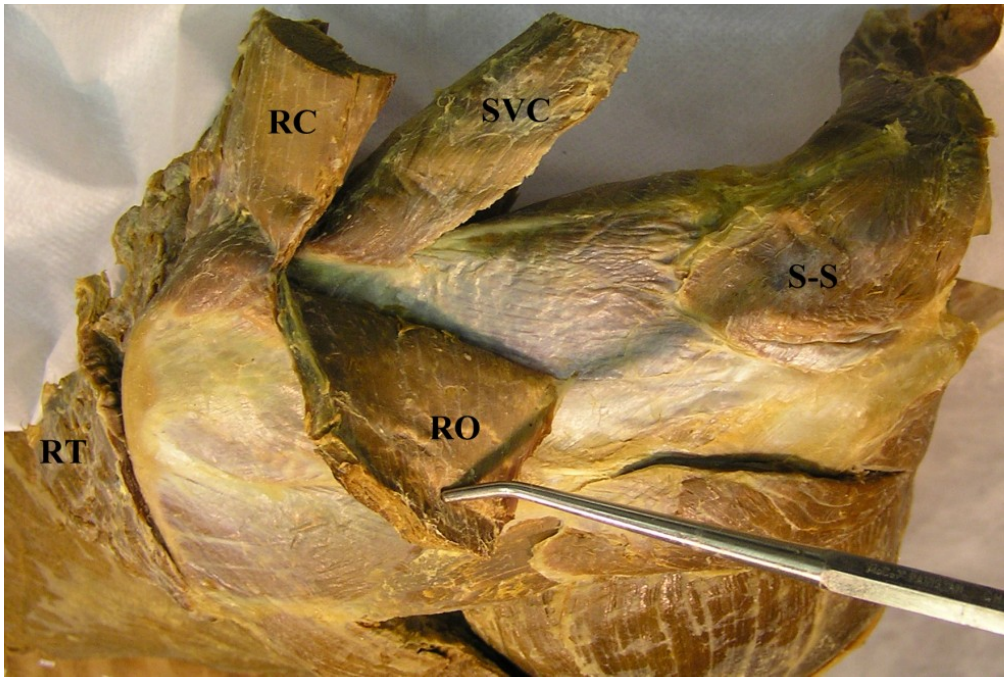


Figure 3.1-6. M. serratus ventralis cervicis inserting on the scapula (P4080009).

[RC- rhomboideus cervicis, RO- rhomboideus capitis, RT- rhomboideus thoracis, S-S- sternoscapularis, SVC- serratus ventralis cervicis]

D. DELTOID GROUP – AXILLARY NERVE

mm. clavodeltoideus, acromiodeltoideus, spinodeltoideus, teres minor

M. clavodeltoideus is covered at its origin by strong fascia of the trapezius complex, which binds the muscles at the clavicle. M. clavodeltoideus has a fleshy origin from the lateral two-thirds of the cranial and superficial surfaces of the clavicle. It lies superficial to m. acromiodeltoideus and to the insertion of m. pectoralis superficialis. It extends to the radius, where it inserts deep to the insertion of m. biceps brachii. Both Humphry (1868) and Galton (1870) described m. clavodeltoideus joining the m. biceps brachii but the tendons were fully separate in this specimen.

M. acromiodeltoideus has just over 2 cm of fleshy origin along the entire caudal curve of the acromion. This small, ovoid muscle belly is only ~6 cm long and mostly fleshy fibers. The muscle fuses with m. spinodeltoideus and the two insert via a short, stout tendon into a tubercle on the deltopectoral ridge. Galton (1870) reported a sesamoid below the acromioclavicular joint where m. subclavius inserts and m. acromiodeltoideus originates, but I did not observe this.

M. spinodeltoideus has a 1 cm origin from the fascia over m. infraspinatus, but also has a 1 cm origin via its own thick fascia from the cranial part of the tuber on the spine of the scapula. The muscle belly is also connected by fascia to m. triceps brachii caput longum, although there is a lot of fatty tissue in the fossa between the muscles. Beginning as a flat muscle, it seems to be in a perpendicular plane as it travels over m. triceps brachii caput laterale and merges with m. acromiodeltoideus via thin tendinous fibers. The muscle fuses with m. acromiodeltoideus and the fused muscles insert on the deltopectoral crest just medial to the origins of mm. triceps brachii caput laterale, brachioradialis, and brachialis, and lateral to the insertion of m. pectoralis superficialis.

M. teres minor is a small muscle 1.3 cm in length which originates partly off the fascia of m. infraspinatus and also from the glenoid third of the caudal border of the scapula. It has a connection with the deep surface of the metacromion process and inserts on the distolateral greater tuberosity of the humerus, covering the proximal origin of m. triceps brachii caput laterale. Galton (1870) and Shrivastava (1962c) also noted a tendon to the metacromion, but Thewissen & Badoux (1986) deny this. A tendon from the teres minor to the metacromion is also found in *Microgale*.

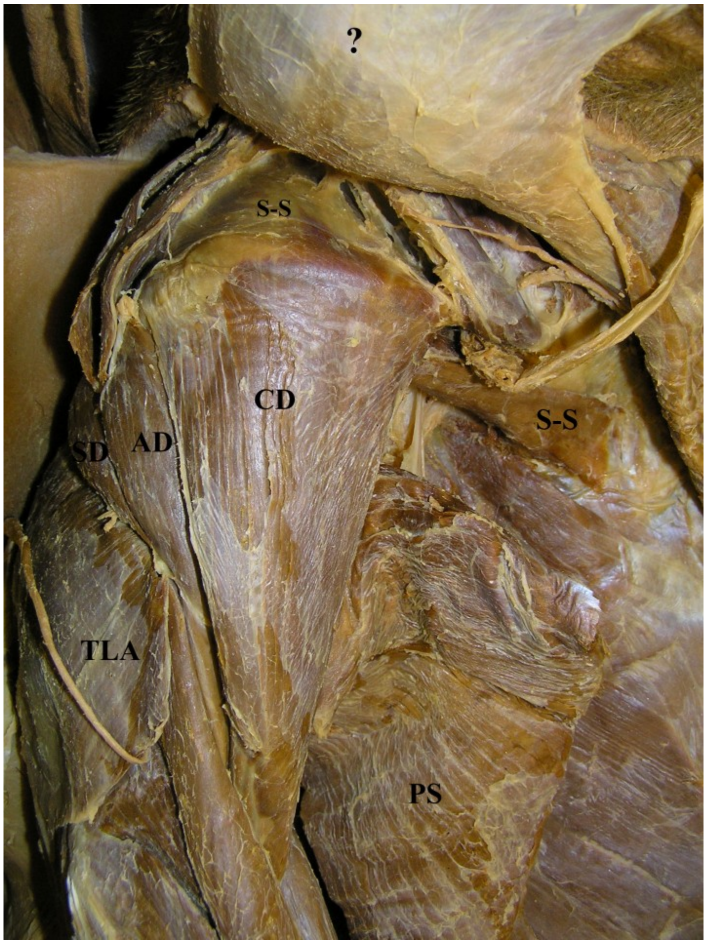


Figure 3.1-7. Mm. deltoideus, cranial view (P4020064)

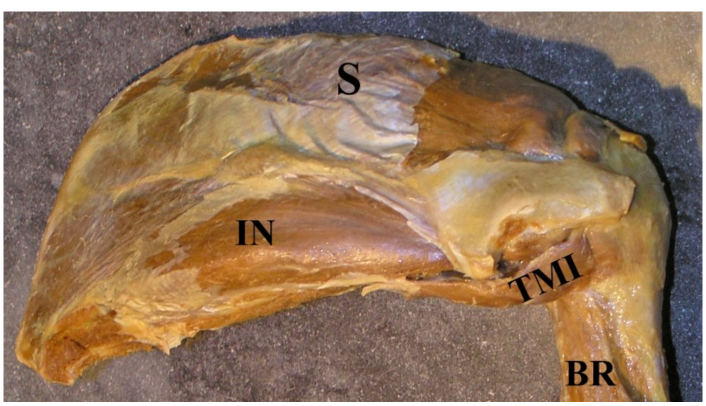


Figure 3.1-8. M. teres minor, lateral view (P7264145)

[?- sternofacialis, AD- acromiodeltoideus, BR- brachioradialis, CD- clavodeltoideus, IN-infraspinatus, PS- pectoralis superficialis, S-S- sternoscapularis, S- supraspinatus, SD-spinodeltoideus, TLA- triceps brachii caput laterale, TMI- teres minor]

E. SUBSCAPULARIS GROUP – SUBSCAPULAR NERVE

mm. subscapularis, teres major

M. subscapularis originates from the majority of the subscapular fossa, leaving marked ridges on the bone. The muscle is 14 cm long x 8 cm wide and its surface is covered by shiny tendinous fibers. It inserts via a remarkably robust tendon into a fossa on the lesser tuberosity and also onto the glenohumeral joint capsule.

M. teres major is a 3 cm wide, flat, thickened muscle which has no bony origin. Instead, it originates from the caudal edge of m. subscapularis, evidence that the two muscles are derived from the same muscle layer (Diogo et al., 2009). At origin it is in close relation to m. dorso-epitrochlearis; Galton (1870) claimed they are fused but I did not observe any shared muscle fibers, only a slight connection of their fasciae. M. teres major crosses over m. latissimus dorsi and fuses stoutly with the deep surface of the muscle. The majority of the tendon of insertion appears to originate from m. latissimus dorsi, with m. teres major remaining fleshy almost to their insertion on the medial humerus deep to m. coracobrachialis.

F. LATISSIMUS GROUP – THORACODORSAL NERVE

m. latissimus dorsi

In *Orycteropus* m. latissimus dorsi is an enormous, triangular sheet of muscle which merges with m. panniculus carnosus. M. latissimus dorsi originates paravertebrally from the thick, white lumbo-dorsal fascia, from the T6-13 vertebral spinous processes, and via a robust digitation of muscle from ribs 10-12. Around the caudal angle of the scapula m. latissimus dorsi is 1.5 cm thick. It gives partial origin to a 1.5 cm-wide bundle of muscle, m. dorso-epitrochlearis. M. latissimus dorsi continues for 3 cm and then fuses firmly with m. teres major. Their tendon inserts on the medial edge of the bicipital ridge of the humerus deep to m. coracobrachialis. Although Humphry (1868) claimed there were blended fibers between mm. triceps brachii caput longum and latissimus dorsi, I believe this must only be m. dorso-epitrochlearis.

M. latissimus dorsi overlies m. rhomboideus thoracis, and from beneath the caudal edge of m. rhomboideus thoracis emerges the thoracodorsal nerve to enter m. latissimus dorsi 1.5 cm from its cranial border. Deep to the rib origin of m. latissimus dorsi is m. serratus dorsalis, and just anterior to that muscle a large cutaneous vessel emerges from between ribs and pierces through m. latissimus dorsi.

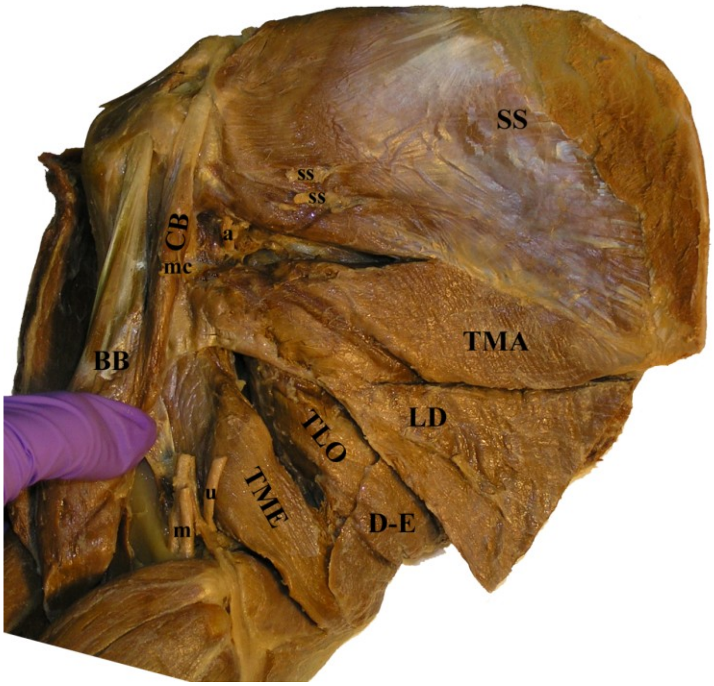
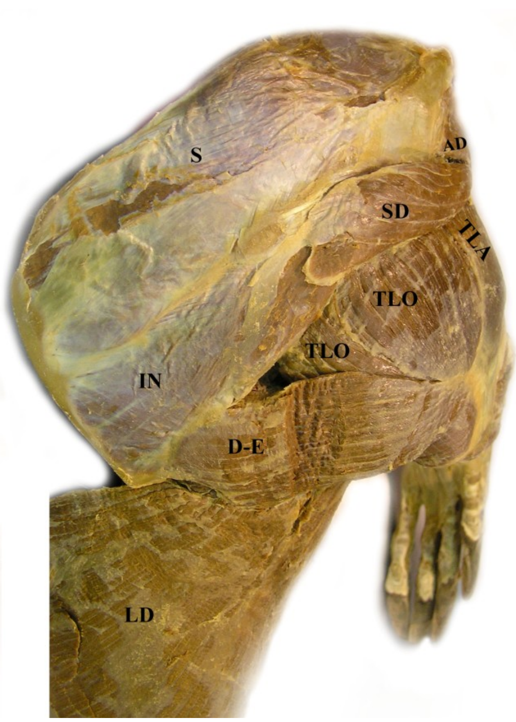


Figure 3.1-9. Mm. teres major and subscapularis (P7254065)

A. 

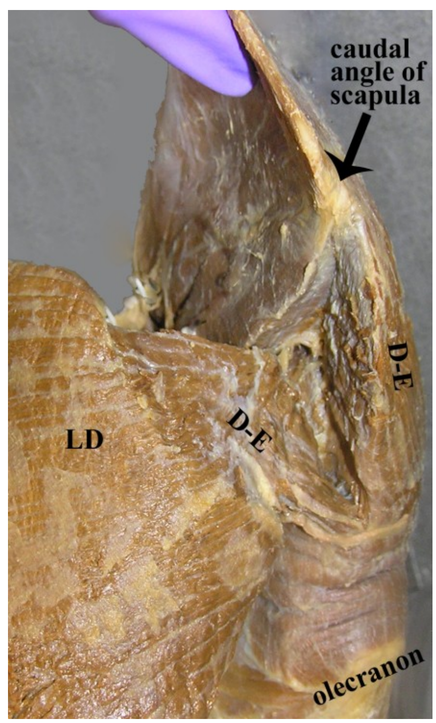
B. 

Figure 3.1-10. Mm. latissimus dorsi and dorso-epitrochlearis

A. Dorsal view (P4090024). B. Caudal view.

G. PECTORALIS GROUP – PECTORAL NERVES

mm. panniculus carnosus, pectoralis superficialis, pectoralis profundus, pectoralis abdominalis, subclavius, sternoscapularis

The m. panniculus carnosus covers the back, sides, and stretches over the lateral thigh to reach the knee. It is thoroughly intermingled with m. latissimus dorsi, and so very thick it had to be carved away from the skin to access the deeper muscles. In the axilla, slips of panniculus carnosus join the mm. pectoralis superficialis, pectoralis profundus, and latissimus dorsi. It also has an insertion on the pectoral crest. This is the "abdomino-humeralis" of Sonntag (1925).

M. pectoralis superficialis is a particularly well developed muscle incompletely divisible into two parts: superficial and deep. The superficial portion of m. pectoralis superficialis is a robust 1.5 cm thick. It is covered proximally by the cutaneous m. sternofacialis and itself covers m. sternomastoideus, part of the deep portion of m. pectoralis superficialis, mm. pectoralis profundus, sternoscapularis, and subclavius. It originates for 5 cm along the manubrium and sterno-clavicular joint. The fibers are directed horizontally across the chest, and its bony insertion is 4 cm long on the medial side of the deltopectoral crest of the humerus. Humphry (1868) and Galton (1870) claimed there was no attachment to the clavicle, but Sonntag (1925) stated that the muscle covers the sterno-clavicular joint.

The deep portion of m. pectoralis superficialis is much broader with a 12 cm origin along the midline of the sternum, but it is also much thinner than the superficial portion of the muscle. Its fibers run diagonally compared with the horizontal fibers of the superficial portion of m. pectoralis superficialis. It inserts for 7.5 cm across the cranial surface of the humerus, joined proximally with the insertion of the superficial portion of m. pectoralis superficialis and paralleling the insertion of pectoralis profundus distally. It also inserts as 4.5 cm of tendinous slips that join with mm. biceps brachii, clavodeltoideus, and brachialis. Humphry (1868) also noted m. pectoralis superficialis joining with muscles of the arm and forearm. It is also fused on its medial side with m. pectoralis profundus via 7 mm of crescentic tendinous fascia, and on its caudal edge with m. panniculus carnosus via both fleshy and tendinous fibers.

The external jugular vein emerges from between the superficial portion of m. pectoralis superficialis and m. clavodeltoideus, passes over the clavicle, and continues superiorly into the neck. Entering the deep surface of m. pectoralis superficialis are two fairly robust pectoral nerves which emerge from between mm. sternoscapularis and sternothyroideus. The more caudal nerve also gives one branch to m. sternoscapularis.

M. pectoralis profundus is a broad sheet of muscle deep to m. pectoralis superficialis. It has a 5 cm wide origin from the lateral sternum and runs parallel but caudal to m. sternoscapularis. It has a 5 cm wide insertion via fleshy fibers on the cranio-medial surface of the proximal humerus, also merging with the tough shiny fascia over the tendon of m. biceps brachii. Thewissen & Badoux (1986) agree that there is no costal origin of this muscle, whereas Sonntag (1925), Galton (1870), and Humphry (1868) described an origin from two or three costal cartilages.

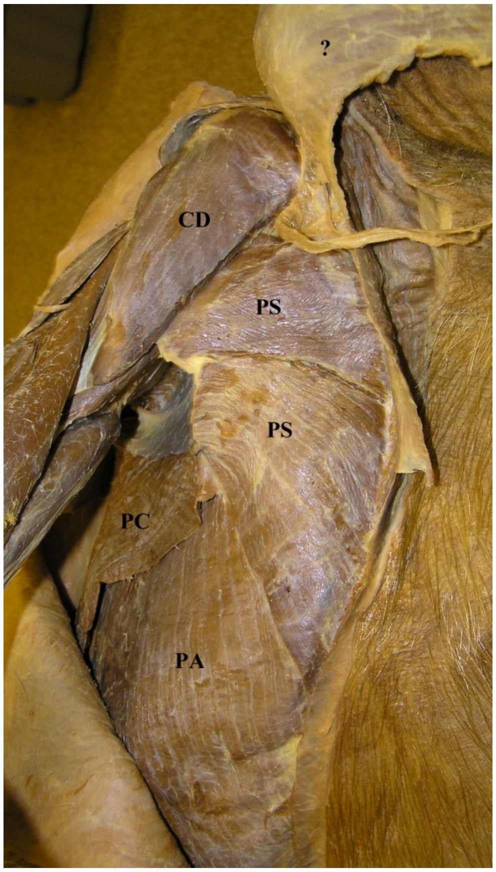
M. pectoralis abdominalis is thick and has a very broad 15 cm wide origin from the xiphisternum and the thorax and abdomen, where it blends with mm. external oblique, latissimus dorsi, and panniculus carnosus. The fibers are directed straight to the axilla angled about 45 degrees to the midline. The muscle has no bony insertion, rather at the level of the elbow it inserts via 3.5 cm of tendinous fascia into the cresenteric fascial sac/bursa at the junction of mm. pectoralis profundus, pectoralis superficialis, latissimus dorsi, and panniculus carnosus. A small triangle of this sac or bursa is visible in Figure 3.1-10B. A similar sac or bursa is found in *Calcochloris*.

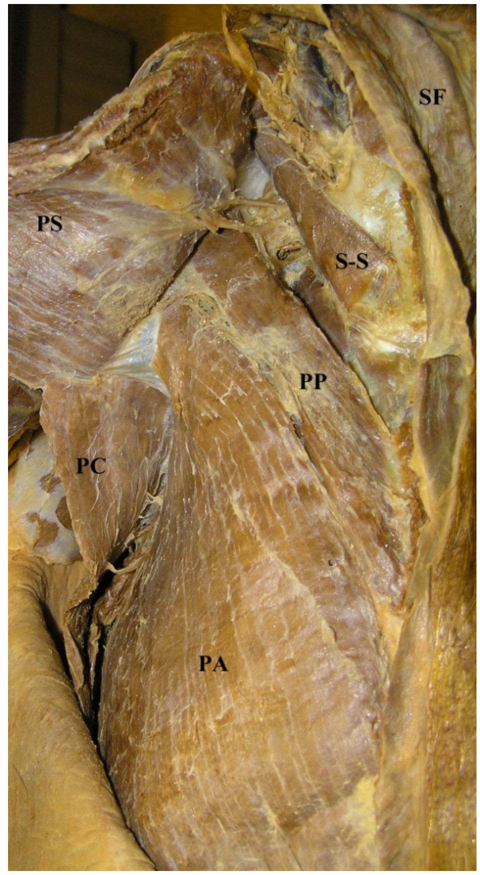
In *Orycteropus*, mm. subclavius and sternoscapularis are divisible, although both Humphry (1868) and Galton (1870) described them as one muscle. M. subclavius arises by dual heads from the first and second costal cartilages and the lateral side of the manubrium, and disappears deep to the medial edge of m. clavodeltoideus. It inserts via mixed fleshy and tendinous fibers on the deep surface of the lateral clavicle. Galton (1870) noted the presence of a sesamoid below the acromio-clavicular joint where fibers of m. subclavius insert and m. acromiodeltoideus originates, but I did not observe this.

M. sternoscapularis can be found just distal and lateral to m. subclavius, and cranial to both portions of m. pectoralis profundus. It also arises from the manubrium and the first rib. The muscle travels deep to the lateral clavicle, and fans out to insert on the cranial edge of the acromion and for 5 cm on the fascia over m. supraspinatus. Galton (1870) also noted an attachment on the coraco-acromial ligament. This muscle is fairly robust and contraction would strongly pull the shoulder anteriorly and cadually or work to counteract strong digging motions and keep the shoulder stabilized.

The thoracoacromial artery emerges cranial to mm. sternoscapularis and pectoralis profundus. Deep between m. sternoscapularis and the clavicle is the subclavian vein, which is joined by the external jugular vein as described above, and also by the cephalic vein near the medial edge of the m. deltoideus.

Figure 3.1-11. Ventral view of aardvark showing mm. pectoralis in situ.

A. 

B. 

C. 

Figure 3.1-12. Mm. pectoralis.

A. Cutaneous muscles reflected showing m. pectoralis superficialis (P3270020). B. M. pectoralis superficialis reflected showing mm. pectoralis profundus and pectoralis abdominalis. Note white triangle is fascial sac/ bursa (P3270029) C. Mm. subclavius and sterno-scapularis. (P4020076)

H. BICEPS GROUP – MUSCULOCUTANEOUS NERVE

mm. coracobrachialis, biceps brachii, brachialis

M. coracobrachialis originates on the medial-most part of the coracoid process of the scapula, and is a 1.5 cm wide fleshy muscle which is split into two parts by the musculocutaneous nerve. The parts fuse again and the muscle inserts via tendinous fibers along the medial humeral shaft, and distally there are fleshy fibers entering an ovoid pit just caudal to the entepicondylar foramen. Thewissen & Badoux (1986) noted a slip to the medial epicondyle. Galton (1870) described it inserting around the condyloid foramen but leaving a passage for the median vessels and nerve.

M. biceps brachii is a single long and fusiform belly, with superficial remnants of a division. It originates via a strong tendon from the supraglenoid tubercle. The tendon passes over the shoulder joint capsule, deep to the 6 mm wide transverse humeral ligament, and occupies the bicipital groove. It inserts into the radius superficial to the insertion of clavodeltoideus. Galton (1870) described m. clavodeltoideus joining the lateral side of its tendon and inserting into the medial side of the radial neck.

The origin of m. brachialis begins deep to m. brachioradialis from the caudal neck of the humerus, and travels laterally along the humerus between m. brachioradialis and the deltopectoral crest. It inserts just distal to the coronoid process of the ulna and just medial to the radius insertions of mm. biceps brachii and clavodeltoideus. Galton (1870) described a slip of m. brachialis inserting on the radius which I did not observe and which was not described by Thewissen & Badoux (1986). Humphry (1868) described the muscle as receiving some fibers from m. biceps brachii, and with radial innervation.

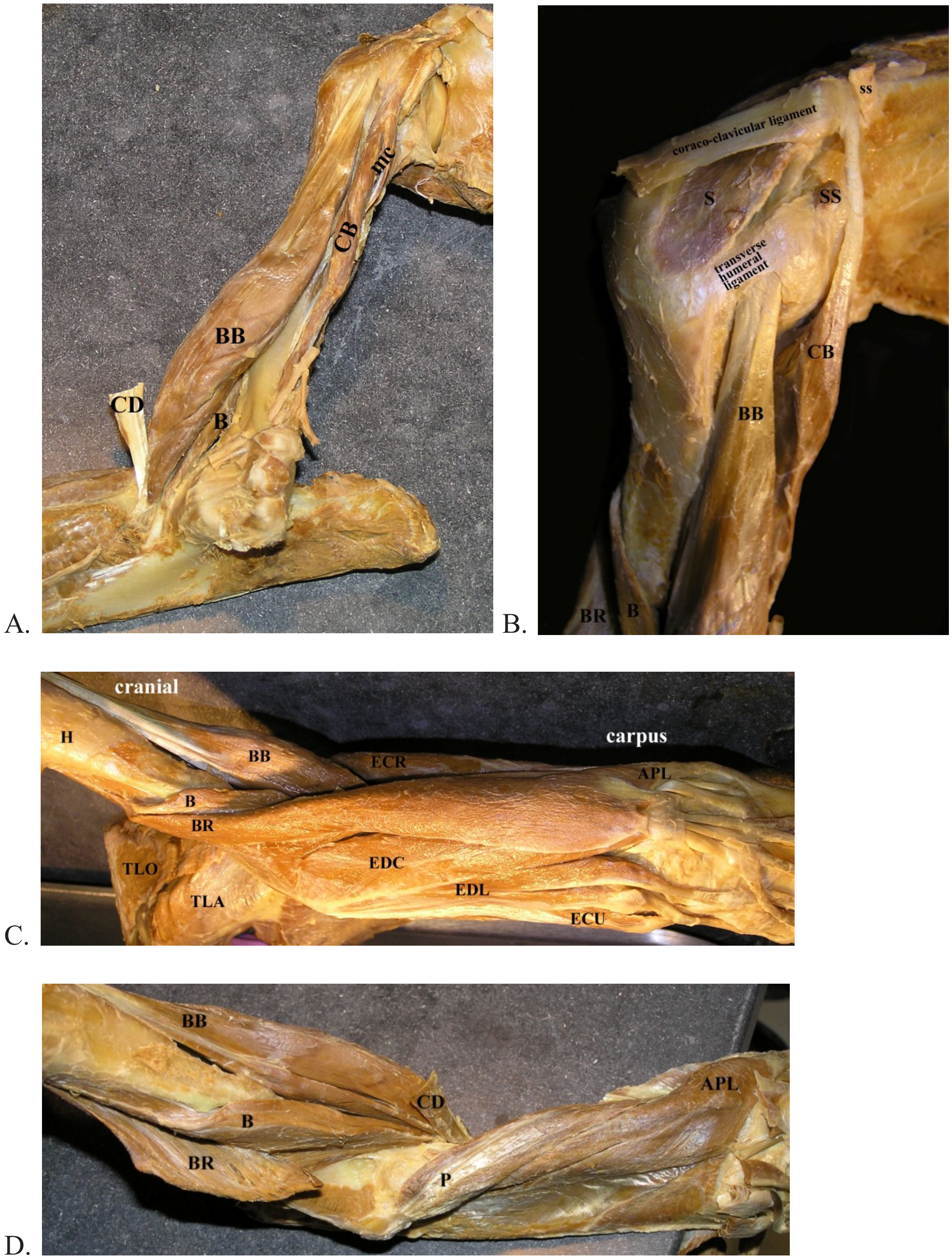


Figure 3.1-13. Muscles of the biceps group.

A. Medial view (P8084395). B. Origins, cranio-medial view (P8054178). C. Cubital fossa, superficial cranial view (P7264149). D. Cubital fossa, deep cranial view (P8084405).

I. SPINATI GROUP – SUPRASCAPULAR NERVE

mm. supraspinatus, infraspinatus

The large m. supraspinatus is covered in shiny white fascia that can be separated from the underlying muscle only with great difficulty. The muscle takes origin from the supraspinous fossa, the cranial surfaces of the scapular spine and coracoid process, and the deep surface of the acromion. M. supraspinatus passes deep to the 8 mm wide coracoclavicular ligament, and inserts broadly on the top of the greater tuberosity. Humphry (1868) described an insertion on the humerus into a groove lateral to the bicipital groove, but I found the muscle ended before the transverse humeral ligament.

M. infraspinatus is 15 cm long and originates from the infraspinous fossa and the caudal surface of the scapular spine. It passes deep to the acromion, which obstructs the view of its insertion into a fossa on the lateral side of the greater tuberosity of the humerus, distal to the insertion of m. supraspinatus and proximal to the insertion of m. teres minor. Galton (1870) noted a bursa deep to its tendon of insertion but I did not.

Figure 3.1-14. Mm. supraspinatus and infraspinatus (P8064227).

J. TRICEPS GROUP – RADIAL NERVE

mm. dorso-epitrochlearis, triceps brachii (caput laterale, caput mediale, caput longum), anconeus

M. dorso-epitrochlearis is complicated in *Orycteropus*, and its anatomy bolsters the claim that m. dorso-epitrochlearis rightly belongs with mm. triceps brachii and not m. latissimus dorsi (Diogo et al., 2009). The muscle has two origins: a 1.5 cm wide fleshy slip from the shiny tendinous coating of m. latissimus dorsi, and a 3 cm wide robust origin from the caudal angle of the scapula. The extent of its origin is marked by a small bony flange on the caudal edge of the scapula near the caudal angle. After 2 cm the two portions fuse stoutly, and insert on the medial and caudal olecranon superficial to mm. triceps brachii. The muscle has previously been described as the "posterior scapular" head of triceps (Humphry, 1868). This condition of m. dorso-epitrochlearis in *Orycteropus* is very similar to m. dorso-epitrochlearis of *Calcochloris*.

The triceps brachii is an extraordinarily robust muscle in *Orycteropus*, and is comprised of the three typical heads: caput longum, mediale, and laterale. The caput longum is partially divided to make a total of four separate heads, but the situation is confused by the partial scapular origin of m. dorso-epitrochlearis. The four heads of triceps brachii which were also noted by Humphry (1868), Galton (1870), and Thewissen & Badoux (1986) undoubtedly incorporated m. dorso-epitrochlearis. The partially divided caput longum is not often noted by anatomists, but I have found two clearly separated scapular origins in most afrotheres and the two artiodactyls dissected by me.

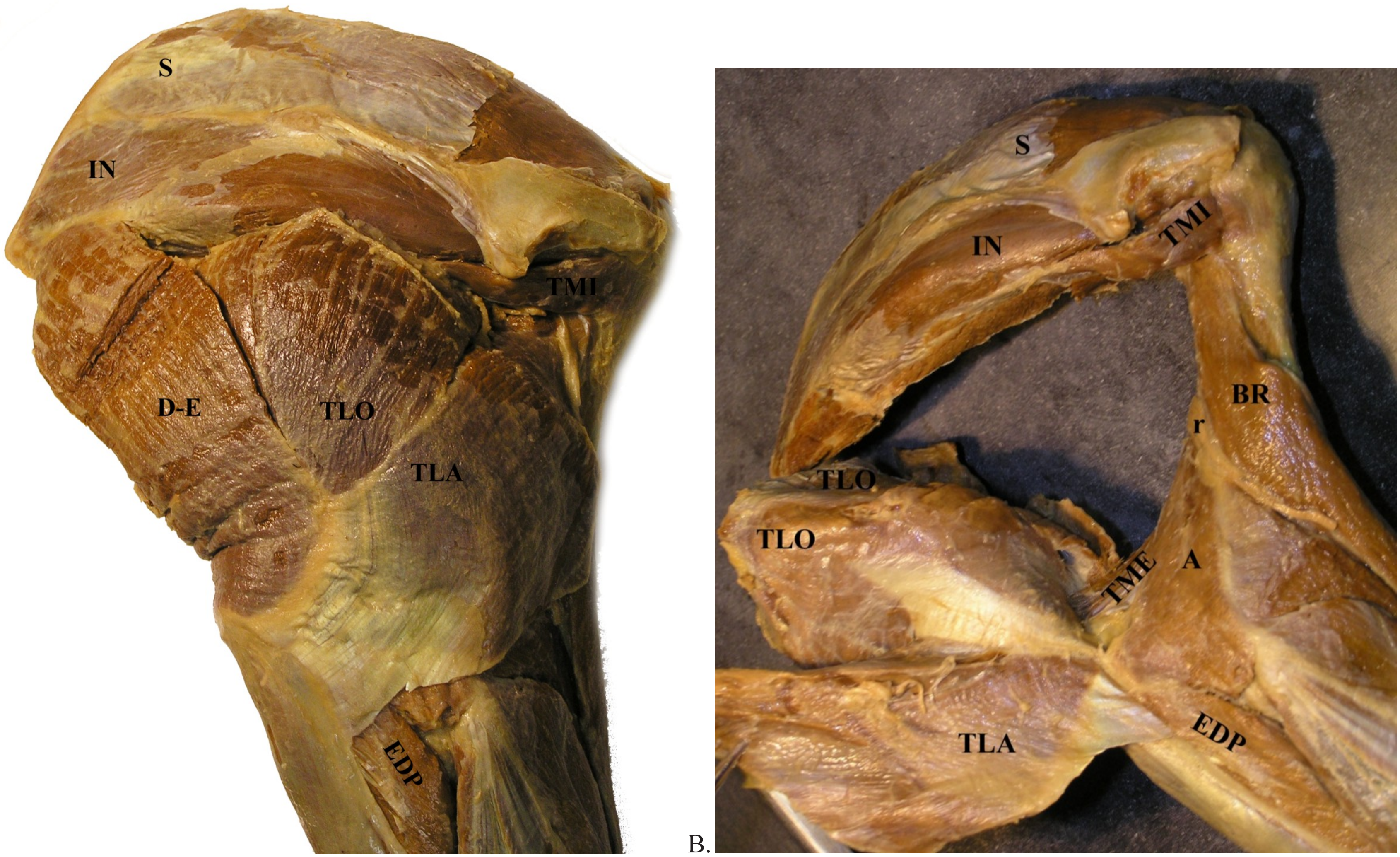
M. triceps brachii caput laterale originates via robust and fleshy fibers from the caudal neck of the humerus, via thin tendinous fibers from the lateral humerus superficial to m. brachialis, and also from the gleno-humeral joint capsule. It fuses with m. triceps brachii caput longum 4 cm after its origin. It inserts on the caudal and lateral olecranon, distal to the origins of mm. extensor digitorum profundus and abductor pollicis longus. Sonntag (1925) and Galton (1870) found this head to be fused with m. triceps brachii caput mediale, but neither I nor Thewissen & Badoux (1986) observed this.

M. triceps brachii caput longum is huge and in medial view is quite separable into deep and superficial portions with the radial nerve visible between them. In lateral view, it appears as a wide sheet that does not seem to be split into two portions. The muscle takes origin from the majority of the caudal border of the scapula, beginning 2 cm medial to the scapular origin of m. dorso-epitrochlearis. M. triceps brachii caput longum superficialis has a 5 cm wide fleshy origin from the caudal border of the scapula. It is covered distally by m. dorso-epitrochlearis, but there is a space between them which appears to be occupied by a bursa also observed by Humphry (1868). It inserts on the olecranon connected medially with mm. dorso-epitrochlearis and triceps brachii caput mediale, and laterally with m. triceps brachii caput longum profundum. M. triceps brachii caput longum profundum has a 1.2 cm wide tendon of origin which is completely separable from m. triceps brachii caput longum superficialis. Its origin is marked by a rugosity on the caudal edge of the neck of the scapula. It has the most central insertion on the tip of the olecranon, between mm. triceps brachii caput laterale and triceps brachii caput longum profundum. Humphry (1868) described an insertion on a ridge just beyond the olecranon and Galton (1870) described an insertion into a fossa on the posterior olecranon, but my skeletal specimen did not seem to have either a fossa or a ridge there.

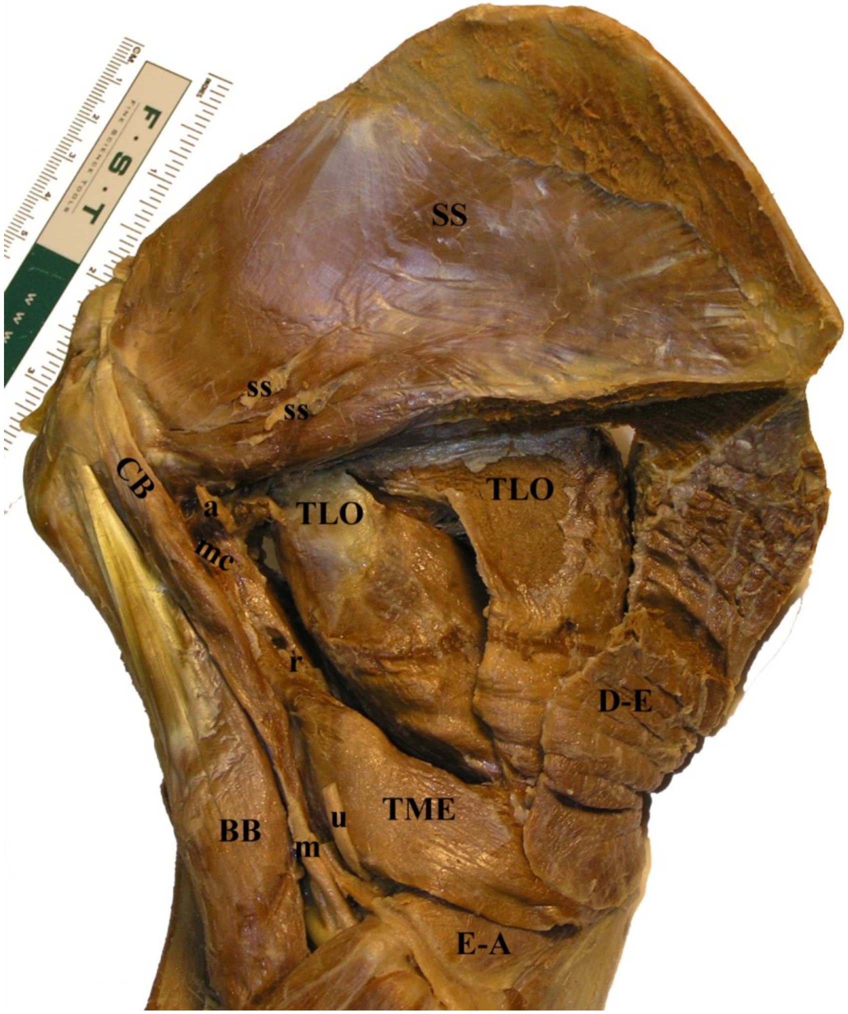
M. triceps brachii caput mediale has an extensive origin from the medial side of the caudal humeral shaft and the caudal supracondyloid ridge, fused stoutly with m. anconeus which has a similar origin on the lateral half of the caudal humerus. M. triceps brachii caput mediale inserts fleshily into the cranial surface of the olecranon process, and onto the caudal surface of m. epitrochleo-anconeus.

M. anconeus originates from the lateral half of the distal caudal humerus and supracondylar ridge, and is fused with m. triceps brachii caput mediale, which also originates from the caudal humerus. It inserts on the lateral olecranon, proximal to the origins of mm. extensor digitorum profundus and abductor pollicis longus, and deep to the insertion of m. triceps brachii caput laterale. Humphry (1868) claimed there is no "anconeus externus" but perhaps m. anconeus was more fused with m. triceps brachii caput mediale in his specimen or was overlooked.

The radial nerve emerges from deep to m. brachioradialis to travel across the surface of m. brachialis. It sends a branch deep to m. supinator which supplies the extensor muscles, a branch into m. supinator, and then a branch that travels along the deep surface of m. extensor carpi radialis.



A. B.
Figure 3.1-15. Mm. triceps brachii.
A. Superficial lateral view (P7254095) B. Deep lateral view (P7264135)



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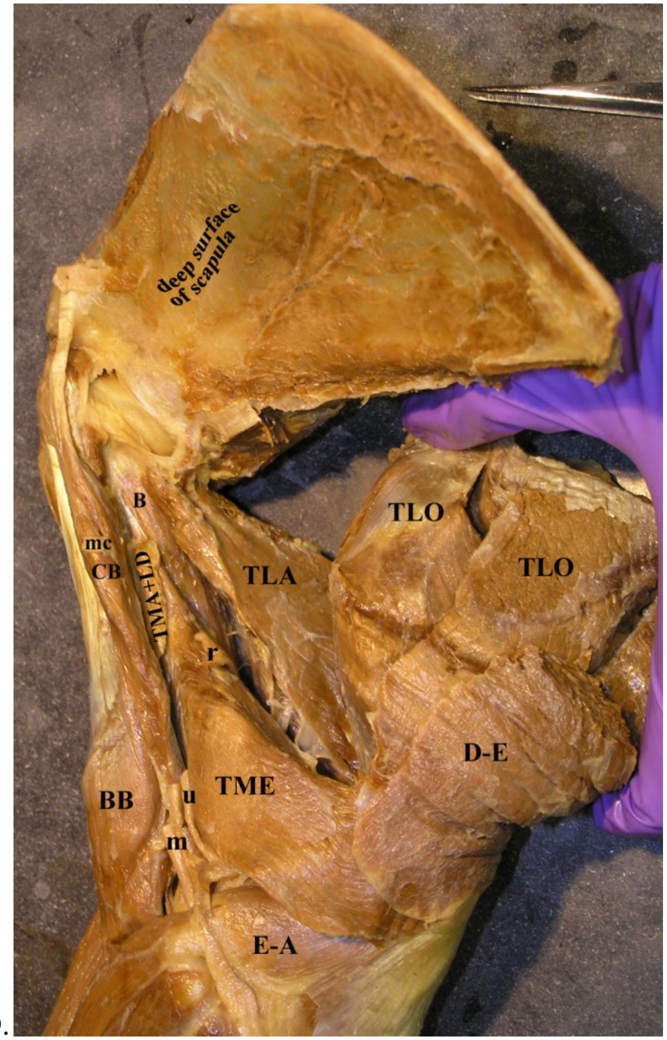


D.

Figure 3.1-15 continued. Mm. triceps brachii.
C. Superficial medial view (P7254085) D. Deep medial view (P7264128)

K. EXTENSOR GROUP – RADIAL NERVE

mm. brachioradialis, extensors carpi radialis longus et brevis, extensor digitorum communis, extensor digitorum lateralis, extensor carpi ulnaris, supinator, abductor pollicis longus, extensor digitorum profundus

Sonntag & Woollard (1925) described both axillary and radial innervation for m. brachioradialis in *Orycteropus*. However, I observed only radial innervation of this muscle, so I have continued the use of the term m. brachioradialis. No other afrothere dissected by me has m. brachioradialis, although a m. brachioradialis similar to that described in *Orycteropus* has been reported in paenungulates (Murie & Mivart, 1865; Murie, 1872; Nielsen, 1965; Domning, 1977, 1978). M. brachioradialis muscle originates from the caudal neck of the humerus superficial to m. brachialis and in a line extending just medial to the lateral supracondylar crest, where it is slightly fused with the superficial surface of m. brachialis. Crossing into the forearm it covers the origin of m. extensor carpi radialis. Distally, the muscle is long and flat and 2.5 cm wide, and inserts on the tough retinaculum surrounding the tendons of m. extensor digitorum communis over the carpus and on a tubercle at the distal radius.

M. extensor carpi radialis longus et brevis are fused at origin, for 3.5 cm along the supracondylar ridge. After 8 cm, the muscle splits into two bellies, which groove the surface of m. pronator teres in the distal forearm. The superficial and medial belly, m. extensor carpi radialis longus, is smaller and crosses deep to m. abductor pollicis longus to insert on the base of metacarpal II. The deeper and more lateral belly, m. extensor carpi radialis brevis, becomes a tendon 2 cm proximal to the carpus, unlike the other extensors which turn to tendon as they cross over the carpus. M. extensor carpi radialis brevis also crosses deep to m. abductor pollicis longus to insert on the tubercle on the medial side of the base of metacarpal III. About 1 mm separates the two insertions of mm. extensor carpi radialis.

M. extensor digitorum communis originates for 1 cm on the proximal end of the lateral epicondyle, distal to the origin of m. extensor carpi radialis and somewhat fused with the origin of m. extensor digitorum lateralis. The muscle has robust interconnected tendons which travel through a retinaculum confluent with the insertion of m. brachioradialis. It splits into four distinct tendons which extend down the centers of each digit and end by expanding over the distal end of the proximal phalanges of digits II-V. This forms a broad, tough extensor expansion which covers each of the digits.

M. extensor digitorum lateralis has two bellies; a medial one originating partially from the lateral edge of m. extensor digitorum communis, which has been described as "extensor annularis" (Humphry, 1868; Galton, 1870; Sonntag, 1925), and a lateral belly originating only from the lateral epicondyle. The medial/annularis belly of m. extensor digitorum lateralis forms a tough fascia expansion over metacarpal IV, and splits into two tendons as it crosses deep to m. extensor digitorum communis tendon to digit V. The smaller tendon goes to the lateral side of the distal end of the proximal phalanx of digit III, and the larger tendon to the lateral side of the distal end of the proximal phalanx of digit IV. The two tendons also send a slip to the deep surface of m. extensor digitorum communis tendons for digits IV and V, thus connecting all the tendons that insert on the lateral digits. The lateral belly of m. extensor digitorum lateralis travels deep to a tough retinaculum. It has an extensive fascial and tendinous insertion into the lateral side of the proximal and middle phalanges of digit V. In the male specimen, it also has a tendinous slip inserting onto the ulnar sesamoid bone at the base of digit V.

M. extensor carpi ulnaris has a fleshy origin on the lateral condyle of the humerus. In the male specimen it inserts into a sesamoid on the ulnar side of digit V and the tubercles on the ulnar side of the base of metacarpals IV and V, not as Sonntag describes. In the female specimen, no ulnar sesamoid was observed.

M. supinator originates from the cranial surface of the lateral epicondyle, deep to the origins of mm. extensors digitorum. It fuses with the medial edge of m. abductor pollicis longus and the intermuscular septum and inserts along the lateral side of the supinator crest of the radius, on the opposite side of the bone from the insertion of m. pronator teres and the origin of the radial head of m. flexor digitorum profundus.

The two heads of origin of m. abductor pollicis longus are visible when the other extensors are removed. One is a huge fleshy origin for 10 cm along the entire lateral ulna, and where it is deep to m. extensor digitorum profundus it has a very shiny tendinous coating presumably to decrease friction between the two muscles. The other origin is a fleshy slip off the cranial surface of the proximal end of the radius, very deep to the origin of m. supinator. Where the two heads meet the muscle also takes origin from the interosseous membrane. The muscle travels medial to the retinaculum for m. extensor digitorum communis and inserts on the trapezium and the radial sesamoid contained within the flexor retinaculum.

The only parts of m. extensor digitorum profundus visible in superficial view are the tendons of insertion. When the other extensors are removed, the origin is visible via fleshy fibers from the proximal 7.5 cm of the lateral ulna deep to m. extensor carpi ulnaris and superficial to m. abductor pollicis longus. It is a pinnate muscle which narrows to a slim tendon which appears on its superficial aspect. It travels through the retinaculum deep to m. extensor digitorum communis, and splits into two tendons over the middle of metacarpal III. The tendons insert on the lateral side of the proximal phalanx of digit II, and the medial side of the proximal phalanx of digit III.

Figure 3.1-16. Muscles originating from the lateral epicondyle, cranial view (P4070031).

[AD – acromiodeltoideus, BR – brachioradialis, ECR – extensor carpi radialis, ECU – extensor carpi ulnaris, EDC – extensor digitorum communis, EDL – extensor digitorum lateralis, SD – spinodeltoideus, T1 – TLA]

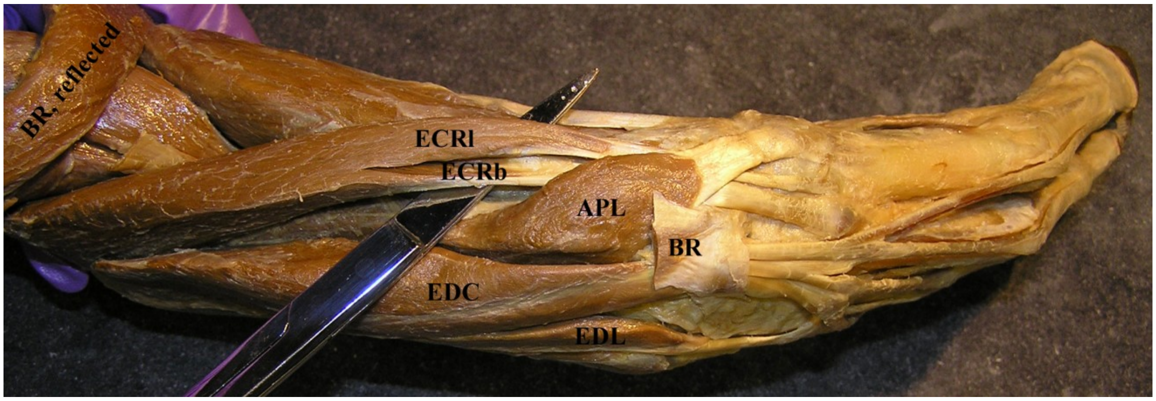


Figure 3.1-17. Mm. extensor carpi radialis longus et brevis (P8054165).

Figure 3.1-18. M. extensor digitorum communis (P8054170).

Figure 3.1-19. M. extensor digitorum lateralis (P8054171).

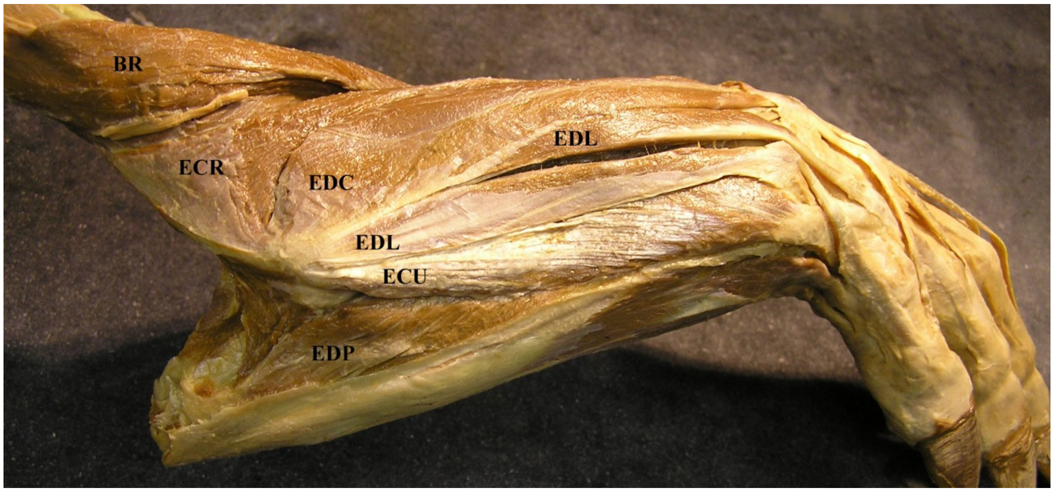


Figure 3.1-20. M. extensor carpi ulnaris (P8054155).

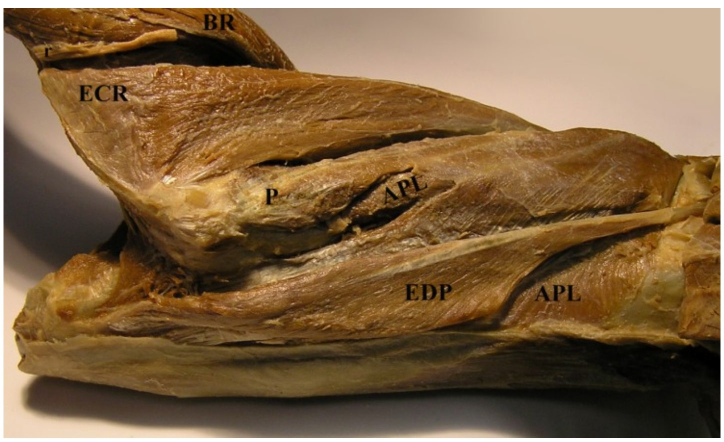


Figure 3.1-21. M. extensor digitorum profundus (P8054204).

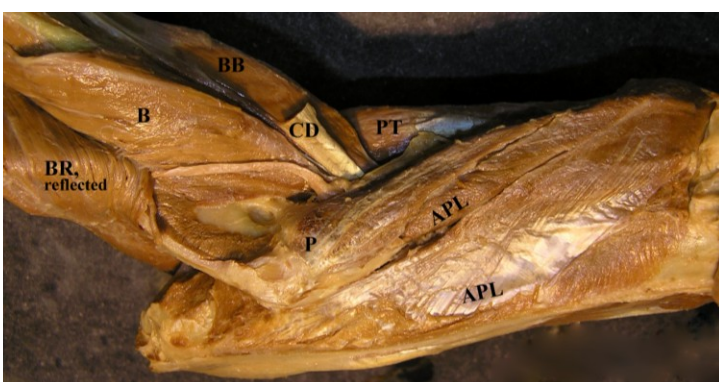
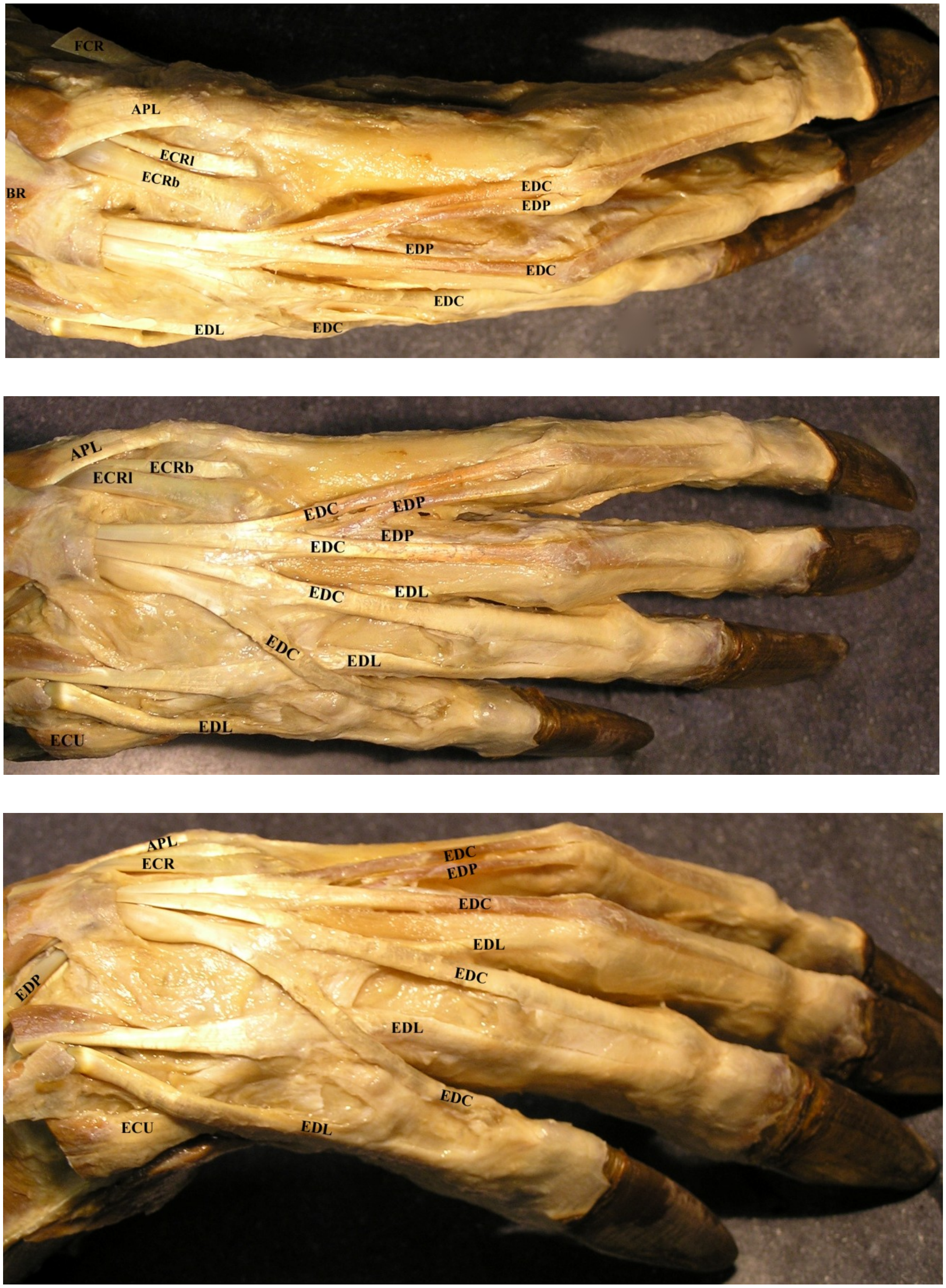


Figure 3.1-22. M. abductor pollicis longus (P8054226).



A.

B.

C.

Figure 3.1-23. Extensor tendons in the manus.
A. Medial side of manus (P8074355). B. Dorsum of the manus (P8074350). C. Lateral side of manus (P8074352).

L. FLEXOR GROUP – MEDIAN and ULNAR NERVES

mm. pronator teres[m], flexor carpi radialis[m], palmaris longus[m], flexor digitorum profundus[m+u], flexor carpi ulnaris[u], epitrochleo-anconeus[u], pronator quadratus[m]

M. pronator teres is a 1.5 cm wide muscle which originates via fleshy fibers from the first or most proximal tubercle on the medial epicondyle, and via tendinous fibers from the second tubercle deep to the origin of m. flexor carpi radialis. It inserts on the distal half of the cranial surface of the radius, deep to m. abductor pollicis longus and on the opposite surface of the radius as the insertion of m. supinator.

M. flexor carpi radialis is 9 mm wide where it originates from the second tubercle on the medial epicondyle of the humerus. It becomes tendinous 3 cm before the carpus, then passes deep to a tough retinaculum medial to the radial sesamoid. It inserts on the styloid process of the radius and on the palmar surface of the base of metacarpal II. Sonntag (1925) described an insertion into the palmar surface of the base of metacarpal I, the radial sesamoid, the styloid process of the radius, and ligaments of the carpals.

M. palmaris longus originates via a strong tendon from the caudal surface of the medial epicondyle, splitting the superficial head of m. flexor digitorum profundus into a U-shape. It is broad and flat. At the carpus it gives a slip toward the radial sesamoid, and from its deep surface a slip that joins with the extremely strong flexor retinaculum that surrounds the huge conjoined tendon of m. flexor digitorum profundus. In the palm, m. palmaris longus gives an expansion to all four digits. The otherwise absent mm. flexor digitorum breves manus may be fused into the deep surface of these palmar expansions.

M. palmaris longus has previously been described as merged with m. flexor digitorum superficialis (Humphry, 1868; Galton, 1870; Sonntag, 1925), and I initially believed that to be the case. However, comparison with other afrotheres reveals a pattern of a well developed m. palmaris longus travelling superficial to or ending at the flexor retinaculum, and a poorly developed m. flexor digitorum superficialis which travels deep to the flexor retinaculum and is strongly connected with m. flexor digitorum profundus. Thus, this large muscle travelling superficial to the flexor retinaculum is probably the palmaris longus.

M. flexor digitorum superficialis has previously been described as merged with m. palmaris longus (Humphry, 1868; Galton, 1870; Sonntag, 1925). I believe the muscle is typically absent in *Orycteropus* and that the muscle described above is only m. palmaris longus. However, Galton (1870) described "a flat and delicate muscular slip" originating from m. flexor digitorum profundus tendon near the most medial m. lumbricale, passing deep to the flexor retinaculum, and inserting on digit III. This is similar to the vestigial m. flexor digitorum superficialis found in *Potamogale*, and in many afrotheres and marsupials the small m. flexor digitorum superficialis takes origin only from m. flexor digitorum profundus (Murie & Mivart, 1865; Coues, 1872; Cunningham, 1882; Sidebotham, 1885; MacCormick, 1886; Parsons, 1896; Osgood, 1921; Sonntag, 1922; Jullien, 1967; Hopwood, 1974; Harvey & Warburton, 2010).

"M. interflexorii" was a tendinous connection between the portions of mm. flexor digitorum profundus in the male specimen. It was not observed in the female specimen. This term has been employed for a variety of such connections between the superficial and deep digital flexors within mammals (Jouffroy, 1971), and seems to be extremely variable. Such a connection has been seen between mm. flexor digitorum superficialis and flexor digitorum profundus in *Tenrec* and *Setifer* (Dobson, 1882) and I observed this in *Rhynchocyon* and *Heterohyrax* as well.

Mm. flexor digitorum profundus is an exceptionally large and presumably very powerful muscle, and removing this muscle from the specimens was quite difficult. It has four bellies of origin: two bellies from the medial epicondyle, one receiving median nerve innervation and one both median and ulnar innervation, one belly from the ulna which receives ulnar nerve innervation, and one belly from the radius which receives median nerve innervation.

The superficial epicondylar belly of m. flexor digitorum profundus (FDPe) is nearly identical to that head of the flexor digitorum profundus muscle seen in *Potamogale*. M. palmaris longus emerges from right in the center of the muscle, making the superficial epicondylar belly U-shaped. The part of the superficial epicondylar belly proximal to m. palmaris longus originates from the third facet on the medial epicondyle, between the origins of mm. flexor carpi radialis and the palmaris longus. Its central tendon remains distinct and at the carpus inserts on the medial edge of the conjoined flexor tendon. It receives a branch of the median nerve. The part of the superficial epicondylar belly just caudal to the origin of m. palmaris longus originates from the flange at the base of the medial epicondyle. It receives one branch from the median nerve and one from the ulnar nerve. It is somewhat split on its medial half, where the median nerve enters the muscle and where in the male specimen it has a "interflexorii" connection with the other half of the superficial epicondylar belly of flexor digitorum profudus. Its lateral edge receives a branch of the ulnar nerve where it passes along the surface of the muscle on its course through the forearm. The muscle remains fleshy until it reaches the flexor retinaculum, where it ends in the huge conjoined flexor tendon.

The deep epicondylar belly of m. flexor digitorum profundus (FDPd) is the smallest belly, only 6.5 cm long. It has the medial-most origin off the medial epicondyle, from a fossa medial to the third facet, making the head deep and medial to that of the superficial belly of m. flexor digitorum profundus. It inserts on the deep surface of the superficial epicondylar belly of m. flexor digitorum profundus near the carpus. It receives a branch of the median nerve.

The radial belly of m. flexor digitorum profundus (FDPr) is visible deep to the epicondylar bellies of m. flexor digitorum profundus. It originates from the medial side of the supinator crest of the radius, adjacent to the insertion of m. supinator. The radial belly of m. flexor digitorum profundus inserts by fleshy fibers on the medial side of the conjoined flexor tendon. It gets a branch of the median nerve.

The ulnar portion of m. flexor digitorum profundus (FDPu) is enormous. It originates from the medial olecranon all the way to the distal ulna, spanning essentially the whole shaft of the bone. It receives a branch of the ulnar nerve.

As they approach the carpus, the four heads of m. flexor digitorum profundus join together to form an 8 mm thick flexor tendon. The huge conjoined tendon passes deep to the flexor retinaculum which stretches from pisiform to radius. The common flexor tendon splits into four tendons which travel through fibrous tunnels binding them to each digit, and insert on the distal phalanges of digits II–V. It also sends a small tendinous slip to the radial sesamoid, possibly the remnant of a tendon for the absent pollex. Galton (1870) also noted a flexor tendon to this sesamoid.

The flexor retinaculum is thick and anchored at its medial and lateral edges by two sesamoid bones embedded within. The oval ulnar sesamoid is 1.3 cm long and 7 mm wide. It is at the base of digit V, just radial to the pisiform and deep to the superficial branch of the ulnar nerve. It glides over the ulnar edge of the conjoined tendon of flexor digitorum profundus, where there are no muscle fibers from the lumbricales. There is also a C-shaped cartilaginous extension of the sesamoid curving deep to the tendon of m. flexor digitorum profundus, ensuring the tendon is well-constrained. What I am calling the radial sesamoid has been referred to as the "deux très-petits os, seuls vestiges du pouce" (Cuvier, 1823). The triangular bone is 1.5 cm long and 9 mm wide and is embedded in the flexor retinaculum near the trapezium, on the radial side of the base of metacarpal II. M. abductor pollicis longus inserts on digit II and on the radial sesamoid. Thus, the radial sesamoid may well be a remnant of the pollex, similar to the small bone seen in hyracoids in the same location which is considered a vestigial metacarpal I (Murie & Mivart, 1865). But, *Potamogale* has all five digits and has a similar ovoid cartilaginous sesamoid in the tendon of insertion of m. abductor pollicis longus, making the true nature of this small bone uncertain. Study of the carpus indicates that both tenrecids and *Petrodromus* have a pre-pollex (Salton & Sargis, 2008), which could be the same bone I observed. Le Gros Clark & Sonntag (1926) deny the presence of a sesamoid bone here in *Orycteropus*, but Galton (1870) noted both the ulnar and radial sesamoids. In Endo et al. (2003), both sesamoids are visible in the 3D CT images depicted in Figure 2D and 3D, but not mentioned in the text. The sesamoids were very clear in both of my specimens and seem to have an important function in anchoring the flexor retinaculum and constraining the very large tendon of m. flexor digitorum profundus.

M. flexor carpi ulnaris has two heads of origin. The ulnar head originates from a 4 cm long broad, shiny tendinous expansion which covers mm. flexor digitorum profundus and epitrochleo-anconeus near the olecranon. It is also attached very thinly along the caudo-medial ulna. The epicondylar head is vestigial and has only the slightest connection with the humerus via thin fascial slips associated with the vessels that sweep around the medial elbow. The two parts quickly join and the muscle inserts by fleshy fibers into the pisiform. Sonntag (1925) and Galton (1870) note other attachments on the unciform and digit V, perhaps due to their inclusion of m. abductor digiti minimi (see section M below), which is somewhat continuous with m. flexor carpi ulnaris.

M. epitrochleo-anconeus originates from a facet on the caudal surface of the first tubercle on the medial epicondyle, near the origin of m. pronator teres from the cranial surface of the first tubercle on the medial epicondyle. It inserts on the rugose ridge on the medial side of the tip of the olecranon process. There is a large fat pad deep to the muscle, cushioning the ulnar nerve from the olecranon process of the ulna. Galton (1870) noted fusion of m. epitrochleo-anconeus with the triceps brachii caput mediale.

The ulnar nerve travels deep to m. epitrochleo-anconeus, giving a branch to it, then sends a branch under the deep epicondylar head of m. flexor digitorum profundus, a branch to m. flexor carpi ulnaris, and travels along the surface of the ulnar head of m. flexor digitorum profundus. It gives a branch to the superficial epicondylar head of m. flexor digitorum profundus in the distal forearm.

The median nerve passes through the entepicondylar foramen with the brachial artery. In the forearm, it promptly sends several branches to the muscles originating from the medial epicondyle, and a deeper branch supplies m. pronator quadratus. The nerve continues on between the superficial epicondylar and radial heads of m. flexor digitorum profundus, to pass deep to the flexor retinaculum.

<u>M. pronator quadratus</u> is a triangular fleshy sheet covering the entire medial surface of the radius and the distal half of the medial ulna.

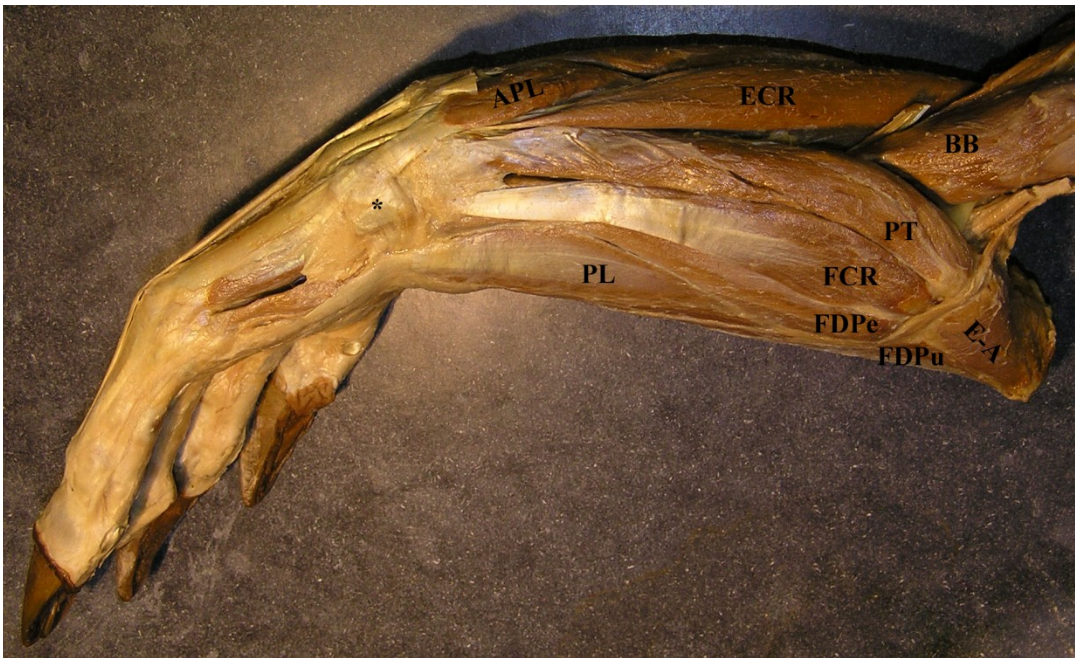


Figure 3.1-24. Muscles originating from the medial epicondyle (P8054169).

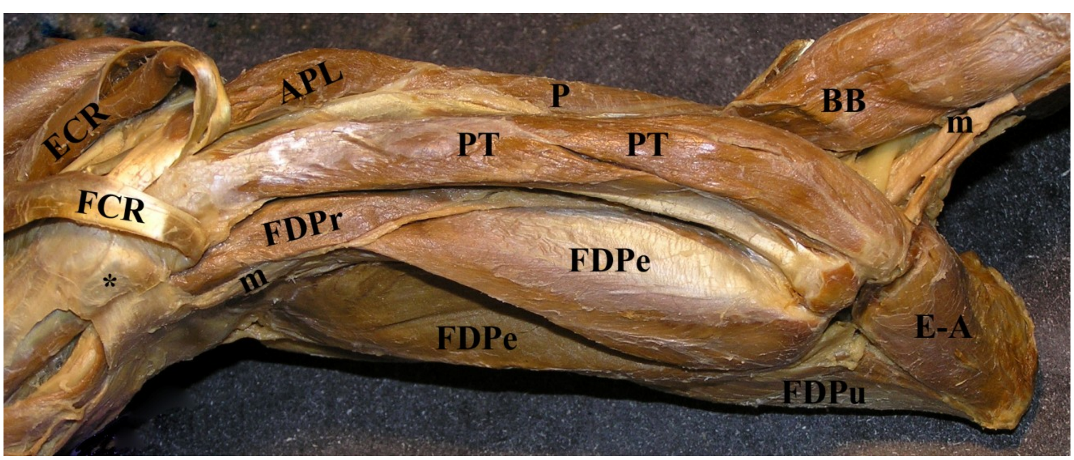
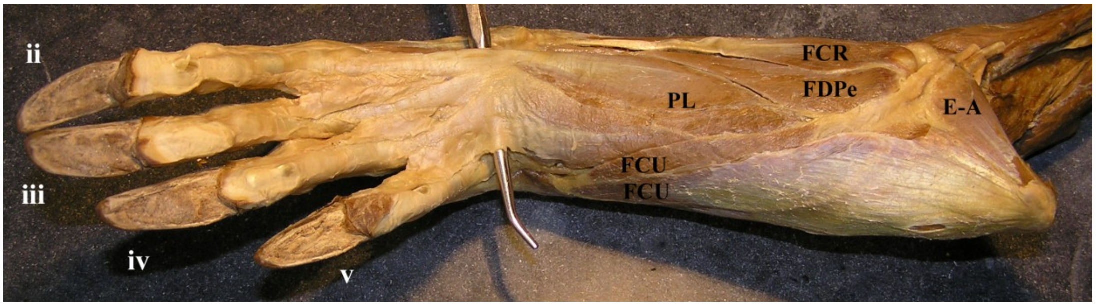


Figure 3.1-25. M. pronator teres, medial view (P8064322).

A. 

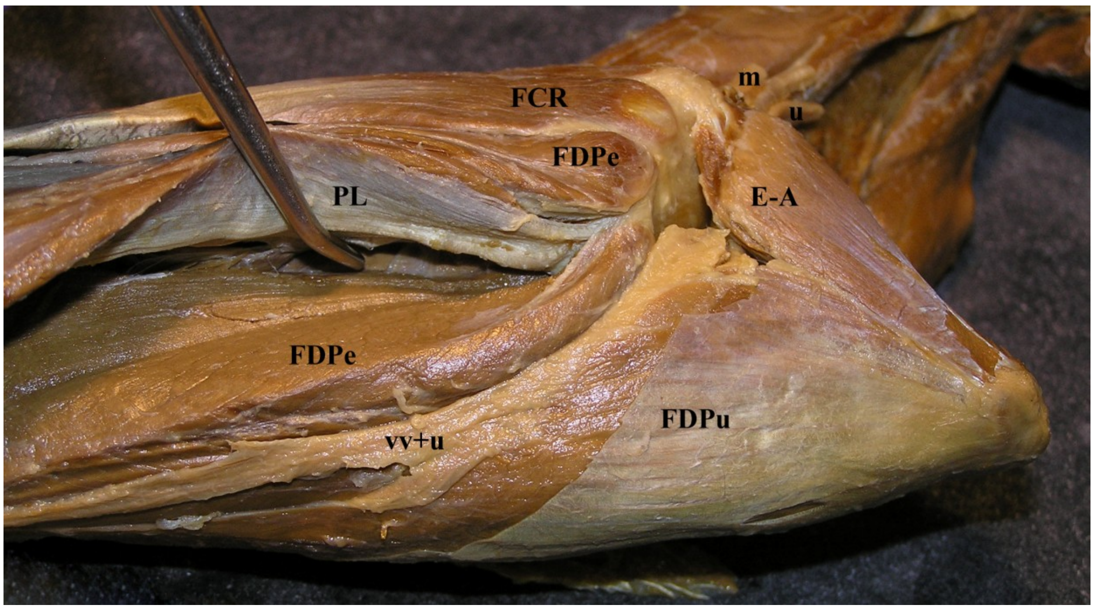
B. 

Figure 3.1-26. M. palmaris longus.
A. Caudal view (P8064239). B. Origin (P8064285)

Figure 3.1-27. Radial sesamoid in flexor retinaculum, superficial to probe (P8064243).

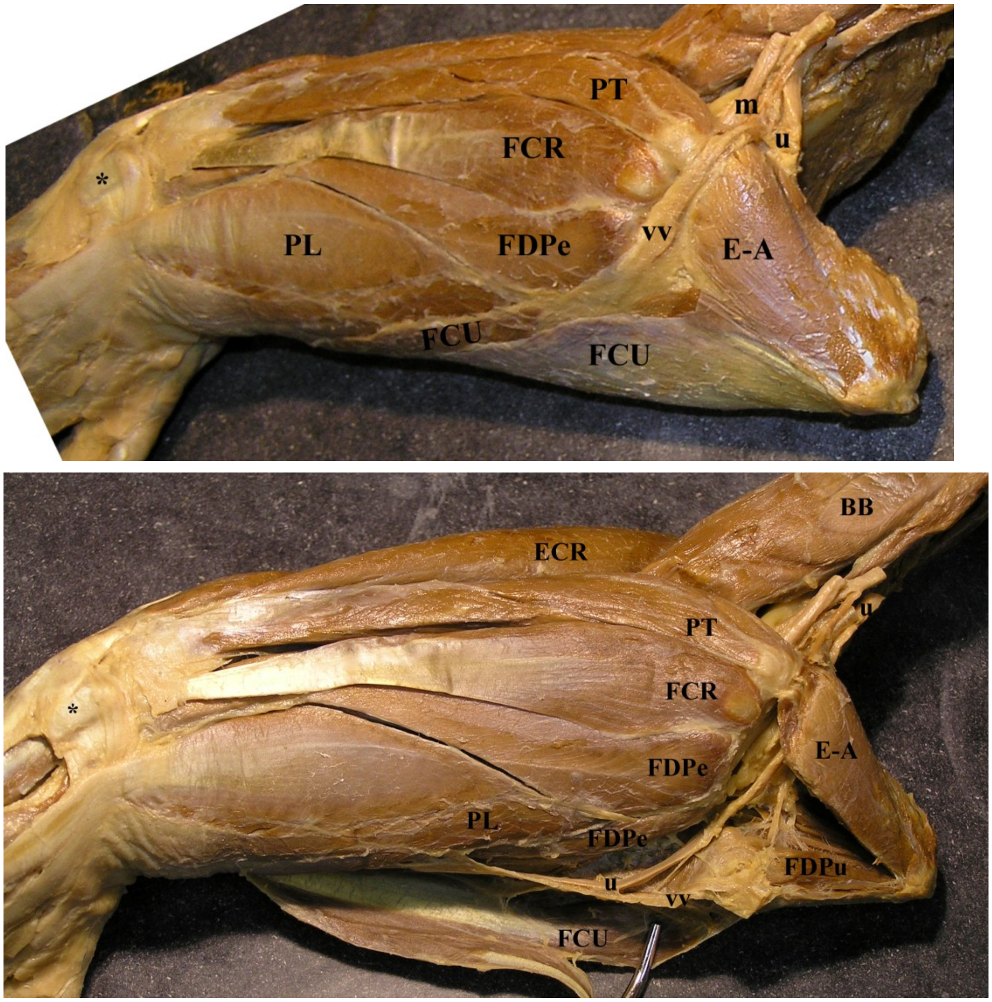


Figure 3.1-28. M. epitrochleo-anconeus.
A. Superficial view (P8054181)
B. Showing ulnar nerve passing deep to m. epitrochleo-anceoneus (P8064250).

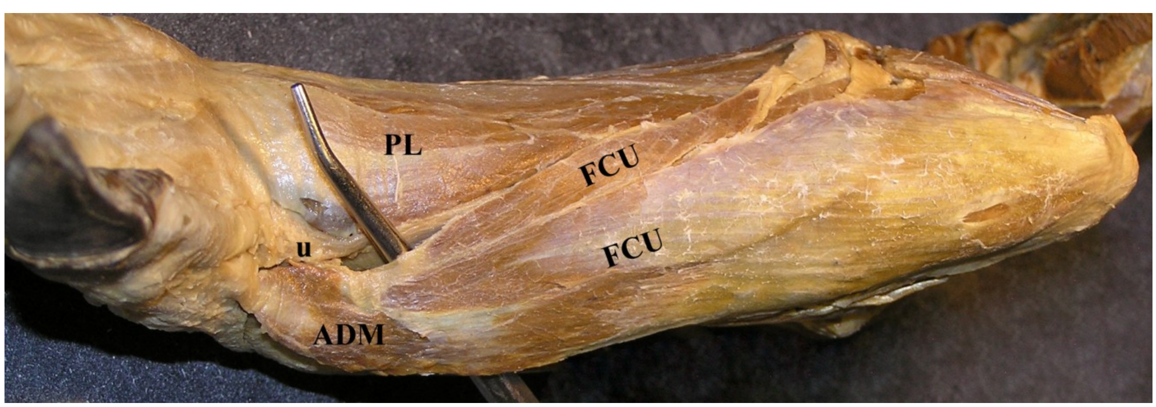
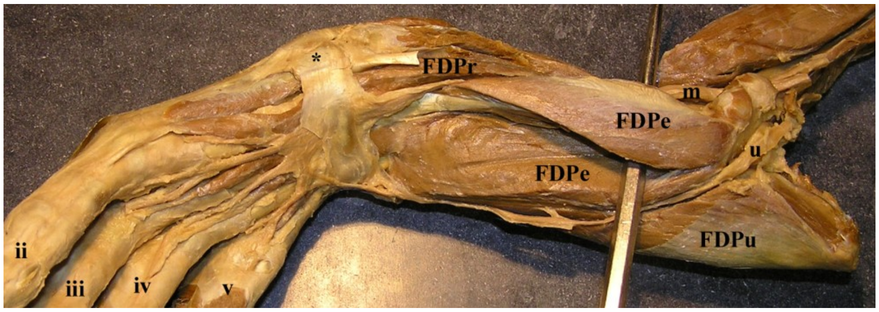
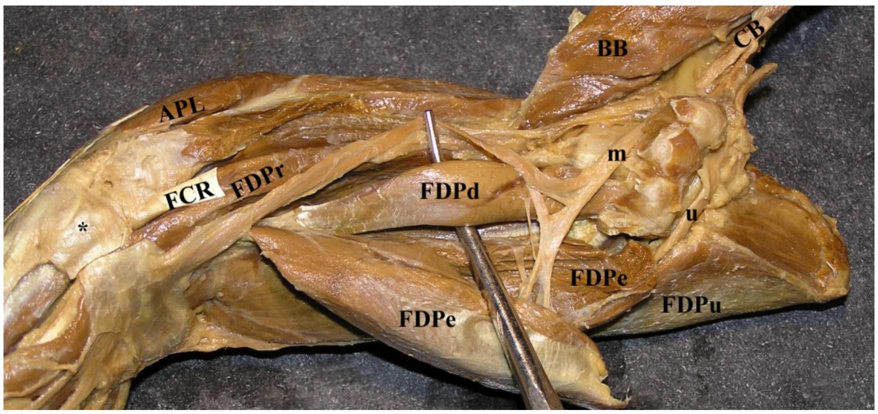
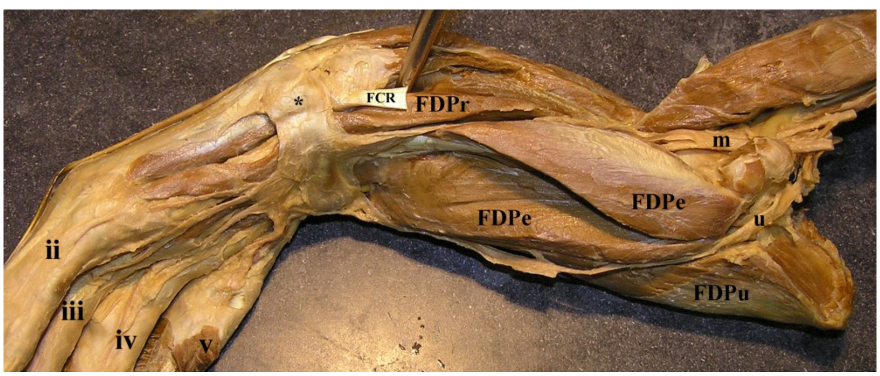


Figure 3.1-29. Mm. flexor carpi ulnaris and abductor digiti minimi (P8064252).

A. 

B. 

C. 

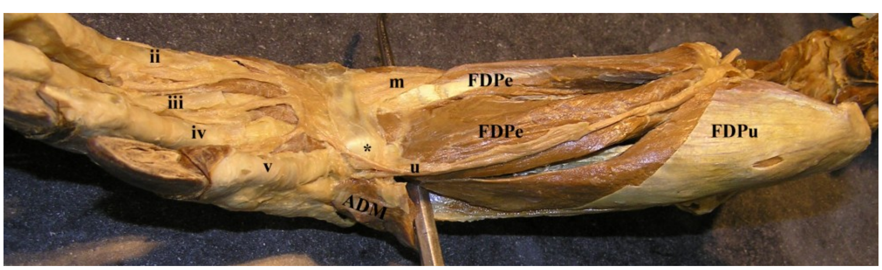
D. 

Figure 3.1-30. Mm. flexor digitorum profundus.

A. Superficial epicondylar head, medial view (P8074328). B. Deep epicondylar head, medial view (P8084369). C. Radial head, medial view (P8074332). D. Ulnar head, caudal view (P8074333).

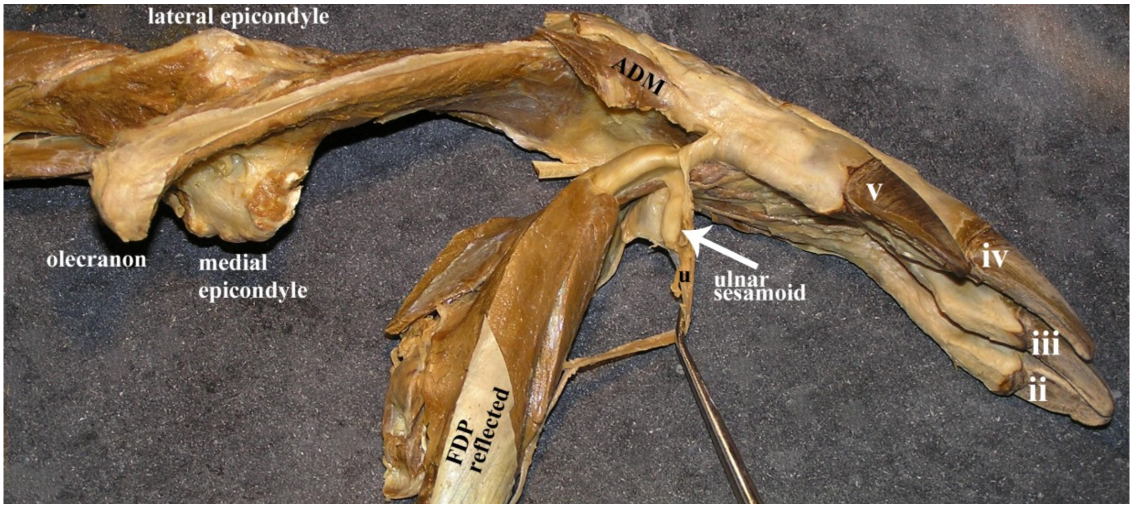


Figure 3.1-31. Conjoined tendon of m. flexor digitorum profundus, caudo-lateral view (P8084372).

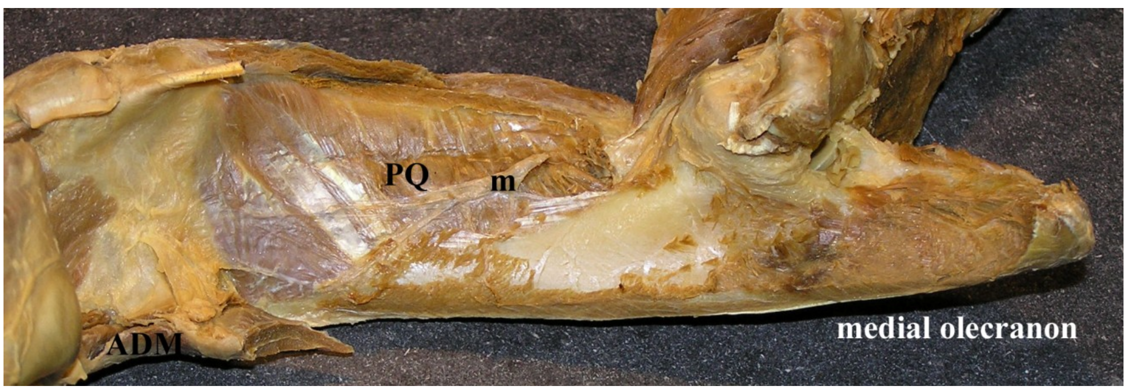


Figure 3.1-32. M. pronator quadratus, medial view (P8084400).

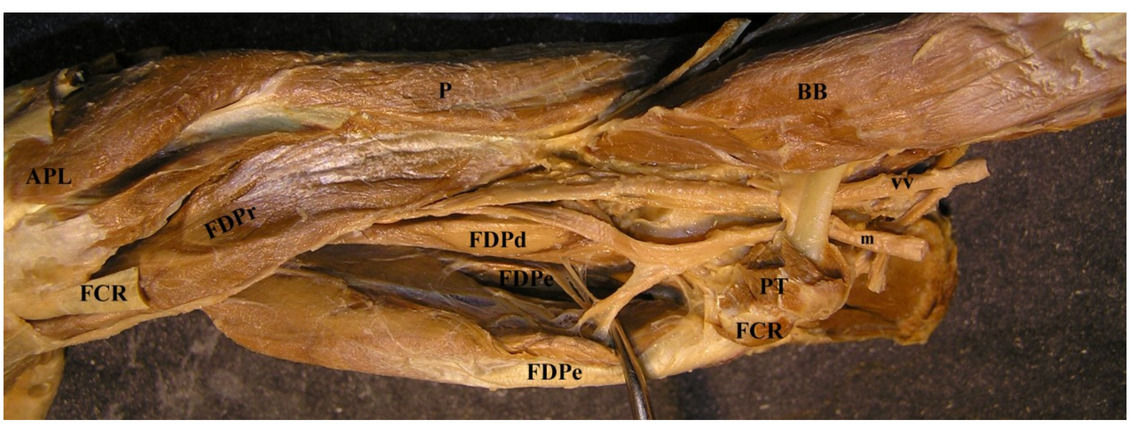


Figure 3.1-33. Median nerve in forearm, cranio-medial view (P8074347).

M. MANUS GROUP – MEDIAN and ULNAR NERVES

mm. flexor digitorum breves manus, abductor digiti minimi^{u}, lumbricales^{m}, contrahentes^{u}, flexor digitorum breves profundus

M. palmaris brevis is absent in *Orycteropus.*

Mm. flexor digitorum breves manus may be absent, or it may be represented by the three or four leaf-shaped bundles of muscle found fused into the deep surface of m. palmaris longus. There are possible slips of muscle and fascia from the deep surface of the palmer aponeurosis which insert on the ulnar side of digit II and the radial sides of digits III-V. Galton (1870) noted that the palmar aponeurosis seemed to be "separable into two layers" which would account for the fusion of mm. flexor digitorum breves manus with the palmar aponeurosis. The absence of the flexor digitorum breves manus in both aardvark is unusual given their robust nature in many other afrotheres.

M. abductor digiti minimi takes origin from the lateral edge of m. flexor carpi ulnaris and from the pisiform, appearing nearly continuous with m. flexor carpi ulnaris. However, the pisiform is firmly attached to both muscles. M. abductor digiti minimi has a small tendon which inserts on a tubercle on the lateral side of the base of metacarpal V. The ulnar nerve travels into the manus just medial to m. abductor digiti minimi.

Mm. lumbricales are 8.5 cm long and innervated by the median nerve. They originate deep to the flexor retinaculum from the superficial surface of the tendon of m. flexor digitorum profundus, and travel along the medial side of each digit under a neurovascular net. They expand distally to insert at the level of the middle of the proximal phalanx of digits II-V, on the medial side of the fibrous tube that binds the tendons of m. flexor digitorum profundus to each digit. The one for digit II is the largest.

There are two mm. contrahentes in the manus, forming an X. They originate from the ligaments on the palmar surface of the carpals. The more superficial m. contrahens originates in the center of the wrist and inserts on the medial side of the metacarpal and proximal phalanx of digit V. The deeper m. contrahens originates from the lateral side of the wrist and inserts on the lateral side of digit II.

The pollex is absent, and there is no m. abductor pollicis brevis.

There are nine mm. flexor digitorum breves profundus. There is a typical pair for each metacarpal II-V, with an additional muscle for digit II acting as an "abductor indicis". A similar "abductor indicis" is also found in *Elephas* (Nielsen, 1965) and the hyracoids, and was previously noted in *Orycteropus* (Galton, 1870; Sonntag, 1925). This "abductor indicis" originates from the deep surface of the radial sesamoid and inserts in common with the medial m. flexor digiti brevis profundus of digit II. The paired mm. flexores digitorum breves profundus for metacarpal V are tiny and insert superficial and deep on the lateral palmar surface of the metacarpophalangeal joint. The other pairs insert on the medial and lateral sides of the sesamoid capsules at the base of the proximal phalanges of digits II-IV. No opponens muscles are differentiated from mm. flexor digitorum breves profundus.

At the carpus, the deep branch of the ulnar nerve travels into the manus medial to the pisiform. It innervates the deep muscles of the manus (Sonntag & Woollard, 1925), however I did not observe distinct branches except to the m. flexor digiti breves of digit V. The superficial branch of the ulnar nerve passes superficial to the flexor retinaculum, crossing over the ulnar sesamoid. Once in the manus, it provides sensory innervation to the lateral side of digit IV and the medial and lateral sides of digit V.

The median nerve passes deep to the flexor retinaculum and lies on the surface of mm. lumbricales in the palm. It gives a tiny branch over m. lumbricale for digit II, which may be a vestige of a sensory branch for the absent pollex. There is also a sensory branch just lateral to m. lumbricale for digit II which innervates the medial side of digit II; a branch just medial to m. lumbricale for digit III splits to provide sensory innervation to the lateral side of digit II and the medial side of digit III; a branch just medial to m. lumbricale for digit IV splits to provide sensory innervation to the lateral side of digit III and the medial side of digit IV; a branch just medial to m. lumbricale for digit V appears to be connected with the superficial ulnar nerve there. The two nerves form a continuous arc in the palm, with a similar arc formed by the ulnar and radial vessels.

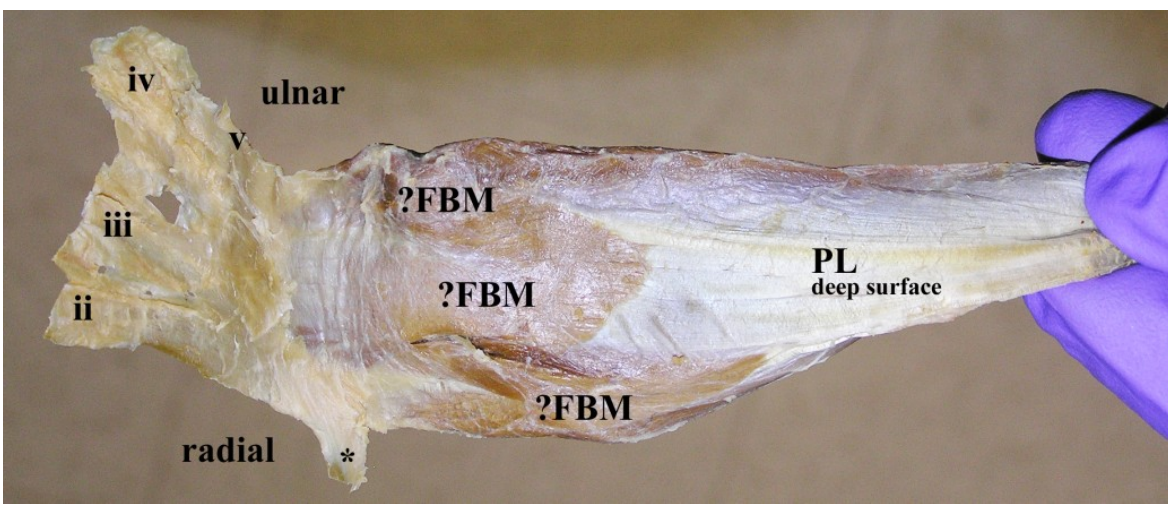


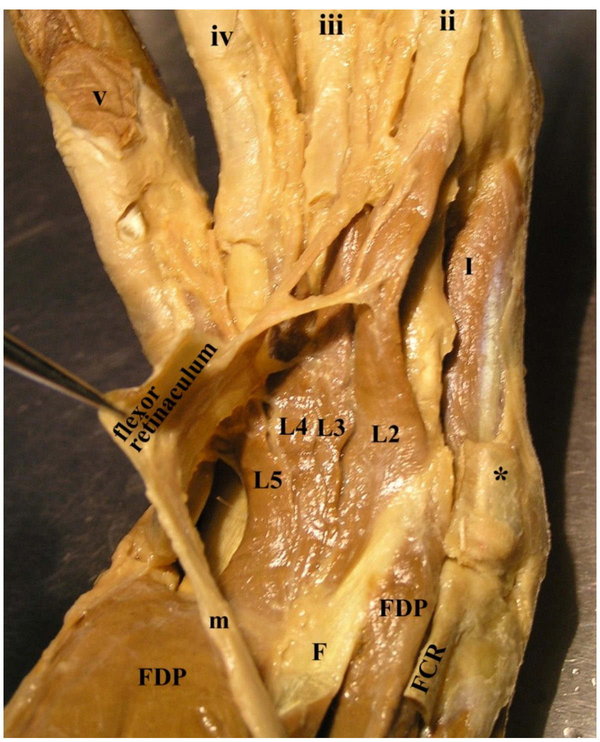
Figure 3.1-34. Mm. flexor digitorum breves manus?
Possible origin from deep surface of m. palmaris longus (P8064309).

[?FBM- flexor digitorum breves manus, PL- palmaris longus, *- attached to radial sesamoid]

A.


B.


?- flexor digitorum breves manus?
*- radial / ulnar sesamoid
ADM- abductor digiti minimi
C- contrahentes
F- conjoined tendon FDP
FCR- flexor carpi radialis
FCU- flexor carpi ulnaris
FDP- flexor digitorum profundus
FDPe- superficial epicondylar head FDP
FDPr- radial head FDP
I- flexor breves digitorum profundus
L- lumbricales
m- median nerve
PL- palmaris longus
PQ- prontaor quadratus

C.


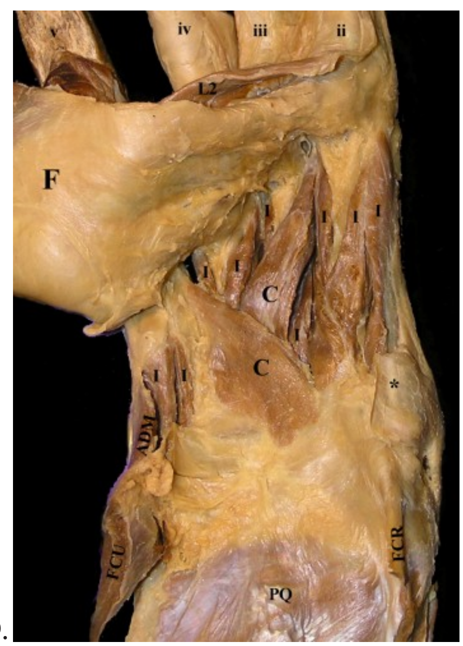
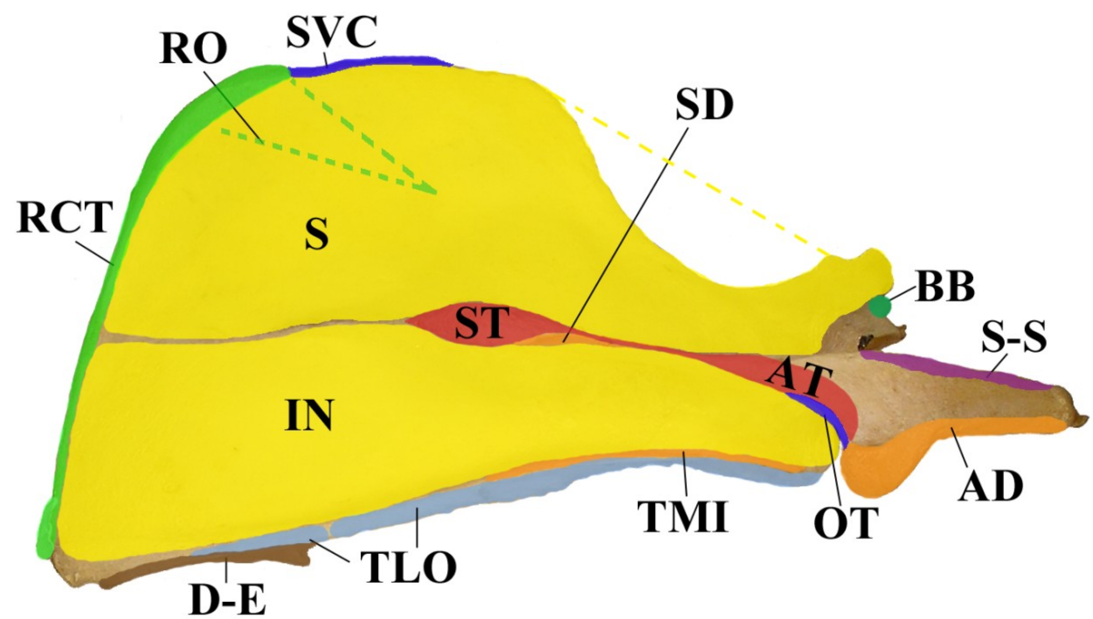
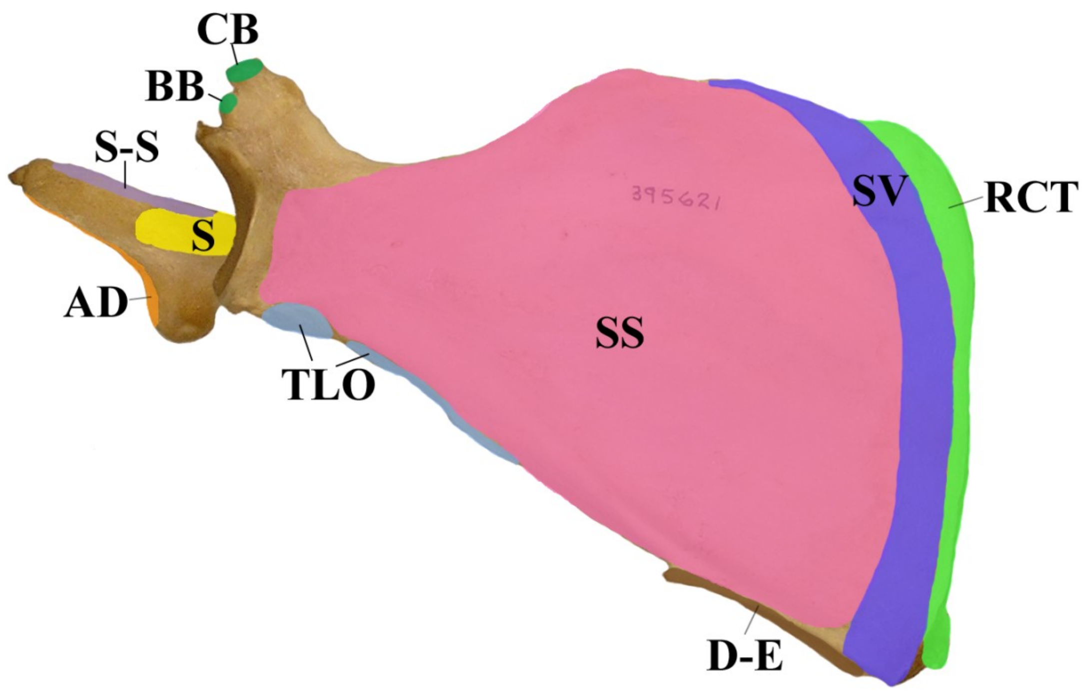
D.


Figure 3.1-35. Muscles of the manus.
A. Insertion of m. palmaris longus, with possible mm. flexor digitorum breves manus. B. Mm. lumbricales, median and ulnar nerves, and flexor retinaculum (P8074326). C. Mm. lumbricales (P8084365). D. Mm. contrahentes and flexor digitorum breves profundus (P8084387).



A.



B.

Figure 3.1-36. Muscle attachment map for the scapula.

A. Superficial surface of the scapula. B. Deep surface of the scapula.

[AD- acromiodeltoideus, AT- acromiotrapezius, BB- biceps brachii, CB- coracobrachialis, D-E- dorso-epitrochlearis, IN- infraspinatus, OT – omotransversarius, S- supraspinatus, S-S- sternoscapularis, SS – subscapularis, SV- serratus ventralis, SVC- serratus ventralis cervicis, RCT- rhomboideus cervicis et thoracis, RO- rhomboideus capitis, TLO- triceps brachii caput longum, TMI – teres minor]

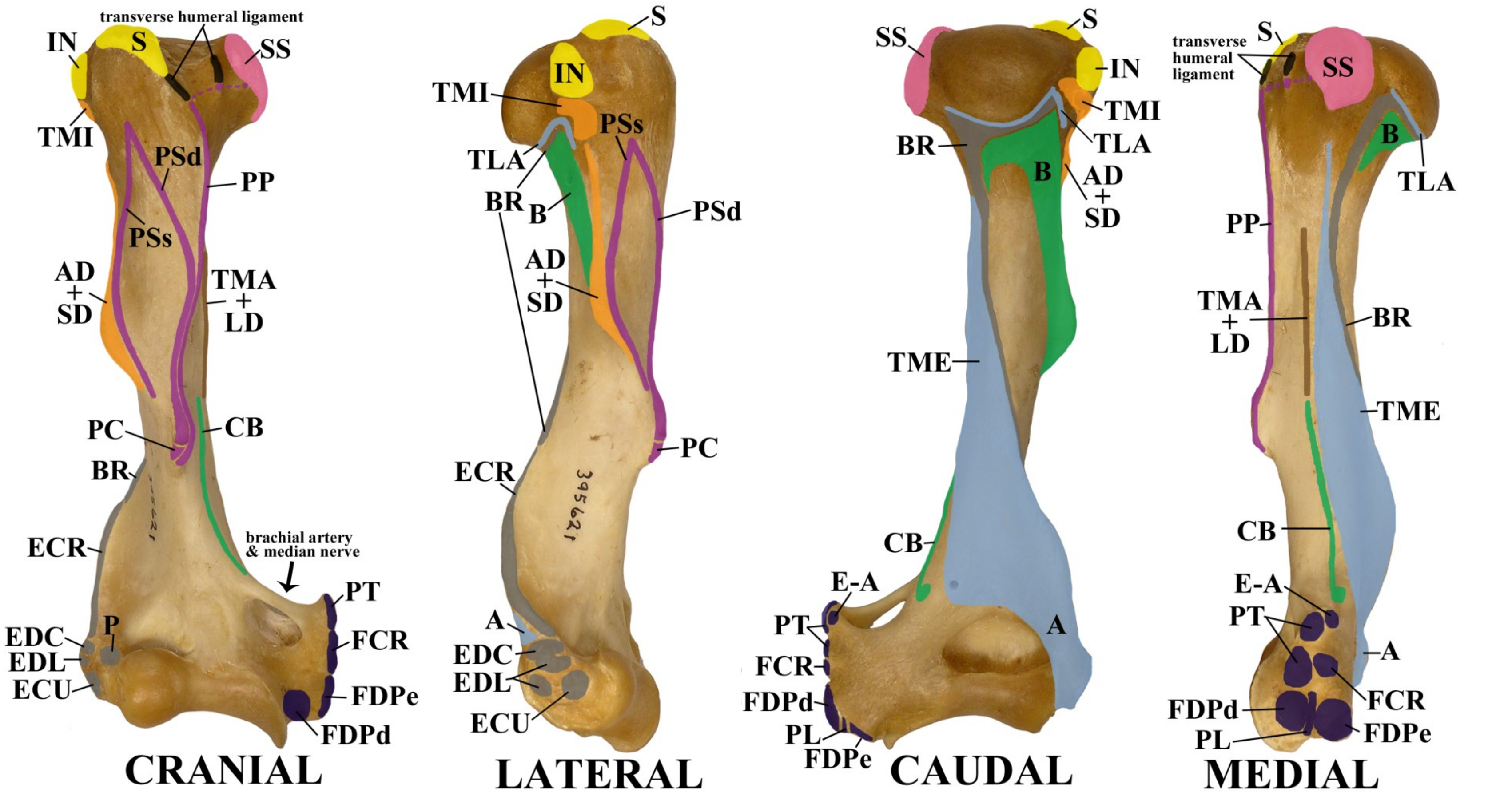


Figure 3.1-37. Muscle attachment maps for the humerus.

[A- anconeus, AD- acromiodeltoideus, B- brachialis, BR- brachioradialis, CB- coracobrachialis, E-A- epitrochleo-anconeus, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, FDPe- superficial portion of flexor digitorum profundus, FDPd- deep portion of flexor digitorum profundus, IN- infraspinatus, LD- latissimus dorsi, PC- panniculus carnosus, PL- palmaris longus, PP- pectoralis profundus, PSd- deep portion pectoralis superficialis, PSs- superficial portion of pectoralis superficialis, PT- pronator teres, S- supraspinatus, SD- spinodeltoideus, SS- subscapularis, TLA- triceps brachii caput laterale, TMA- teres major, TME- triceps brachii caput mediale, TMI- teres minor]

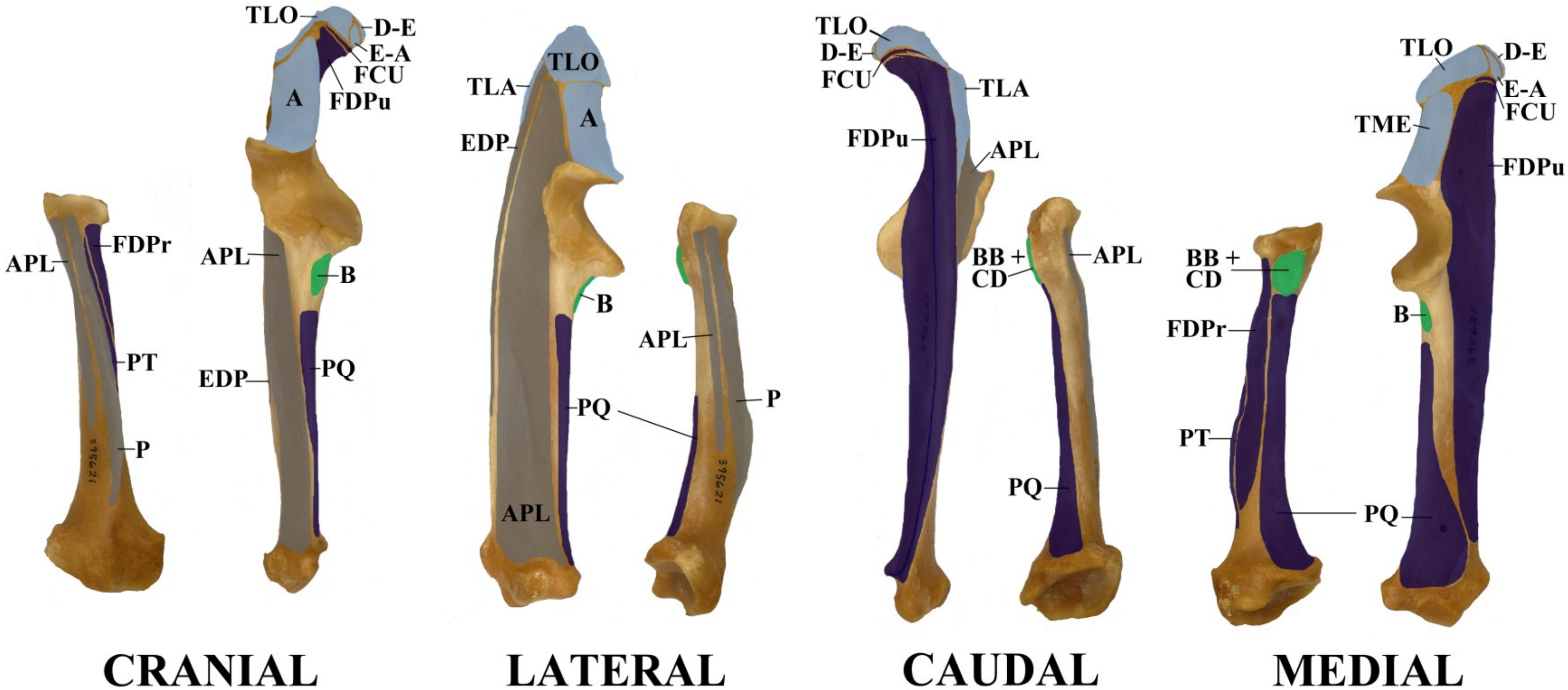


Figure 3.1-38. Muscle attachment map for the radius and ulna.

[A – anconeus, APL – abductor pollicis longus, B – brachialis, BB – biceps brachii, CD – clavodeltoideus, D-E – dorso-epitrochlearis, E-A – epitrochlear-anconeus, EDP – extensor digitorum profundus, FCU – flexor carpi ulnaris, FDPr – radial head of flexor digitorum profundus, FDPu – ulnar head of flexor digitorum profundus, P – supinator, PT – pronator teres, PQ – pronator quadratus, TLA – triceps brachii caput laterale, TLO – triceps brachii caput longum TME – triceps brachii caput mediale]

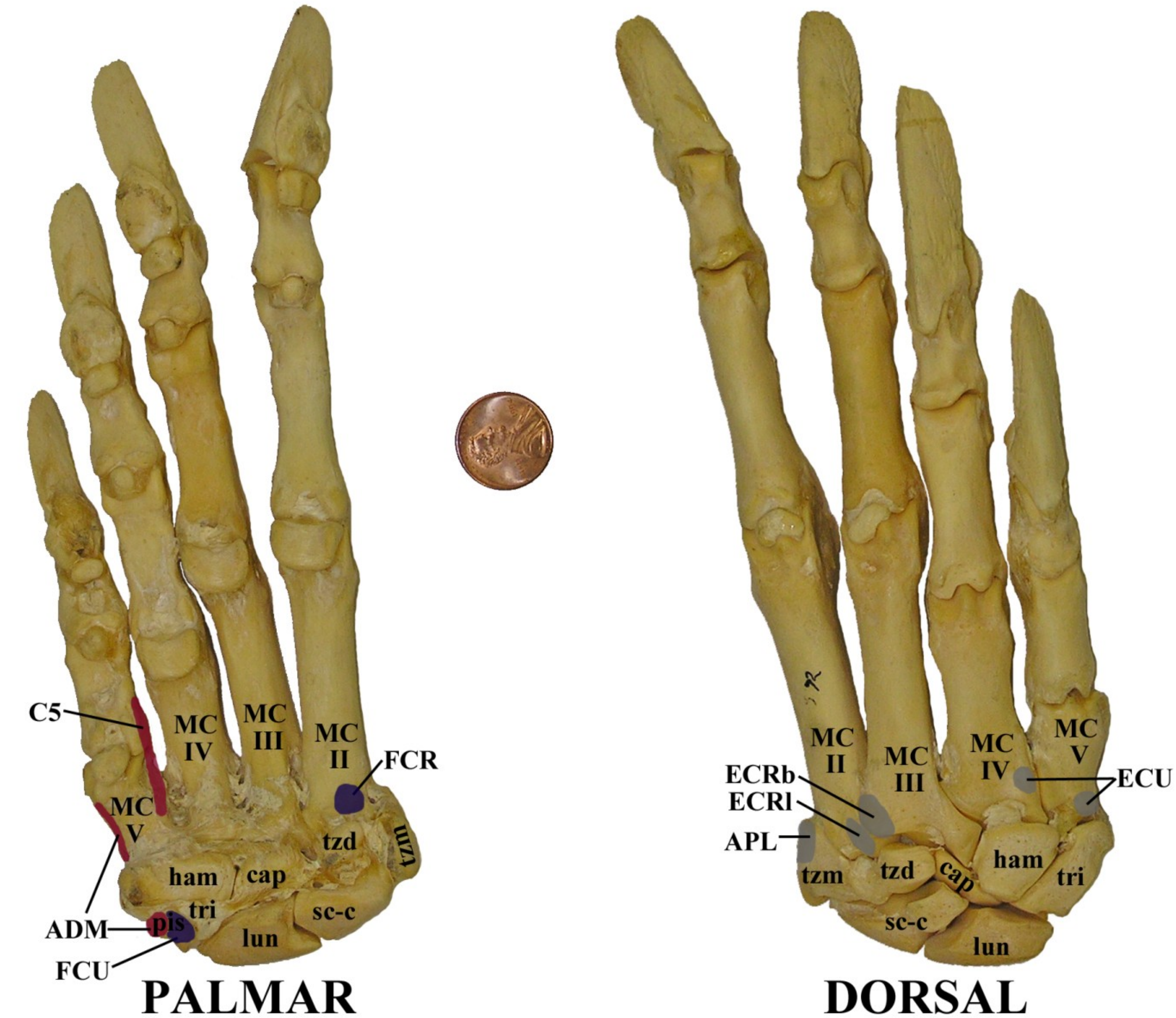


Figure 3.1-39. Muscle attachment map for the manus.

[ADM – abductor digiti minimi, APL – abductor pollicis longus, C5 – contrahens digit V, cap – capitate (magnum), ECRb – extensor carpi radialis brevis, ECRl – extensor carpi radialis longus, FCR – flexor carpi radialis, FCU – flexor carpi ulnaris, ham – hamate (unciform), lun – lunate, pis – pisiform, sc-c – scaphoid-centrale, tri – triquetrium (cuneiform), tzd – trapezoid, tzm – trapezium]

3.2A – Afrosoricida – Tenrecidae – *Potamogale velox*

A description is given of the extrinsic and intrinsic muscles of the forelimb of a female specimen of *Potamogale velox*, the giant otter shrew (Afrosoricida: Tenrecidae) collected for the American Museum of Natural History in the Central African Republic in 1956. The specimen is well preserved, although it is in a state of advanced pregnancy which is not ideal for dissection due to the increased subcutaneous fat and other fat deposits. The abdomen has been incised and the enlarged uterus is visible.

There are only two previous anatomical descriptions of this species, by Dobson (1883) and Jullien (1967). Dobson has some beautiful color illustrations, but says "the myology was worked out with considerable difficulty owing to the badly preserved state of the single specimen of *Potamogale velox* available" (Dobson, 1883: 100). Jullien (1967) provides fairly good descriptions of the muscles, and also had issues with the muscle homologies in this strange animal.

A.

B.

Figure 3.2A-1. Pre-dissection photographs of *Potamogale velox*, AMNH 170171

A. Ventral view (P8250071). B. Lateral view (P8250067).

0. CUTANEOUS MUSCULATURE and MAMMARY GLANDS

mm. cutaneous ventralis, sphincter colli, panniculus carnosus, dorsocutaneous

There is a thick layer of cutaneous musculature, from the midline of the dorsum stretching from neck to tail, very similar to the extensive cutaneous musculature seen in *Orycteropus*. This layer is made up of several portions.

M. panniculus carnosus covers the entire dorsum of the animal and is quite thick. The mammary glands are deep to m. panniculus carnosus. It originates from the dorsal midline and is connected to the caudal edge of the spinodeltoideus, where it inserts on the medial humerus. Also, conspicuous, robust fibers at the hip appear to continue down to insert with the hamstrings. A similar muscle was noted in *Orycteropus*. The cutaneous nerves that pierce m. latissimus dorsi also enter m. panniculus carnosus.

The mammary glands are enlarged due to advanced pregnancy. The axillary gland surrounds the elbow, while the inguinal gland fills the space between the abdomen and the knee. The axillary mammary gland was removed, and a slip of m. cutaneous ventralis entered the deep surface of the gland.

The very thin m. cutaneous ventralis is 17 mm wide, and consists of unorganized tissue that attaches to m. sphincter colli in the ventral neck and passes over mm. pectoralis to fuse with m. panniculus carnosus over the lateral abdomen. Laterally there are connections with mm. pectoralis arranged in three ribbons (2 mm-wide bands), the most medial of which is fused with the deep surface of the enlarged mammary gland. There are discrete slips of striated muscle, m. ilio-marsupialis, inserted on the teats of pouchless marsupials, which has been demonstrated to help “the mother to carry her heavy load of young high above the substratum, so protecting the young from injury or removal" (Griffiths & Slater, 1988: 152). In pouched marsupials this musculature is reduced or vestigial, as it seems to be in *Potamogale*.

On its cranial end, m. cutaneous ventralis appears to share innervation and blood supply with mm. pectoralis. These were unable to be traced back to their source, but are presumably pectoral nerves. However, at its caudal end where it fuses with m. panniculus carnosus, the thoracodorsal nerve emerges from underneath the ventral/lateral edge of m. latissimus dorsi and may also provide innervation to the m. cutaneous ventralis.

<u>M. sphincter colli</u> muscle encircles the neck, originating from the occipital and cervical midlines. It is quite thick and extends over the proximal thorax, reaching the level of the shoulder. It covers nearly all of m. acromiotrapezius, leaving only the caudal edge along the scapular spine visible.

<u>M. dorsocutaneous</u> is deep to the extremely robust m. panniculus carnosus, and is 2 cm wide but paper thin. It originates from the dorsal midline superficial and closely adherent to m. latissimus dorsi, and is also closely adherent to the deep surface of m. panniculus carnosus. It terminates with some curious double folds at the level of the shoulder, deep to m. sphincter colli. A neurovascular bundle emerges from the dorsal edge of m. latissimus dorsi, pierces m. spinotrapezius, and enters m. dorsocutaneous. In this specimen there was a lot of brown fat in the fascia surrounding m. dorsocutaneous.

A. 

B. 

Figure 3.2A-2. Cutaneous musculature.

A. Lateral view (P4290007). B. Ventral view (P4290010).

[PC – panniculus carnosus, VC – cutaneous ventralis]

Figure 3.2A-3. Mammary glands.
A. Axillary and inguinal mammary glands after reflection of m. panniculus carnosus. B. Deep surface of mammary gland showing insertion of m. cutaneous ventralis.

[mg – mammary gland, PC – panniculus carnosus, SC – sphincter colli, VC – cutaneous ventralis]

A. TRAPEZIUS GROUP – ACCESSORY NERVE and CERVICAL NERVE

mm. sternomastoideus, cleidomastoideus, clavotrapezius, acromiotrapezius, spinotrapezius

The trapezius complex in *Potamogale* is bizarre, resulting in much confusion regarding the true identity of the components. Although there are the five individual muscles that one might expect, they do not seem to represent the traditional five components of the trapezius complex. I discuss the issues in the following descriptions. It is important to be clear about the problems here, as was Jullien (1967) in his discussion of *Potamogale*, since the identification of the components of the trapezius complex impacts the interpretation of afrothere myology. Another afrothere, the aardvark, also has a trapezius complex which is similarly difficult to homologize with other mammals.

Despite its robust nature, <u>m. sternomastoideus</u> is not visible in superficial ventral view; it is covered by several layers of muscle. Most superficially the extremely developed cutaneous muscle that encircles the neck, m. sphincter colli, hides all other muscles from view. Deep to that, m. sternomastoideus is covered proximally by the thinner and feebler m. cleidomastoideus, and distally by m. pectoralis superficialis. The muscle has a U-shaped origin from the mastoid process. The proximal 5 mm of fibers join with the contralateral partner to form a thick ventral raphe, with the remaining 1 cm of fibers inserting along the surface of the manubrium and cranial end of the sternum. Dobson (1883) believed m. sternomastoideus to be fused with m. cleidomastoideus, and it is possible that the two muscles are fused and the muscle identified below as m. cleidomastoideus is something else.

M. cleidomastoideus is weak. It originates as a flat ribbon from the lateral occipital crest lateral to mm. clavotrapezius and acromiotrapezius, widens, and inserts superficial to m. sternomastoideus as a thin layer of fascia near the ventral midline. Its termination is deep to m. pectoralis superficialis and superficial to m. sternomastoideus. Jullien (1967) claimed m. cleidomastoideus is absent in *Potamogale* but described this muscle as "sterno-occipital." Verheyen (1961) does not mention m. cleidomastoideus in his description of the closely related *Micropotamogale*. Within mammals, m. cleidomastoideus is typically deep to m. sternomastoideus, but in *Potamogale* it has the most superficial origin of the trapezius components and inserts superficial to m. sternomastoideus. In *Microgale*, *Tenrec* (Dobson, 1882b), macroscelidids (Jullien, 1967), *Elephas* (Anderson, 1883), Sirenia (Domning, 1977, 1978), and hyracoids (Windle & Parsons, 1901), m. cleidomastoideus inserts on the manubrium, which lends some support to the identification of this muscle as cleidomastoideus, but in all of these afrotheres it is found deep to m. sternomastoideus.

M. clavotrapezius is an 8 mm-wide muscle originating from the occiput lateral to the origin of mm. acromiotrapezius and rhomboideus. There is a ribbon of muscle, possibly m. omotransversarius, only a few fibers wide, which snakes between mm. clavotrapezius and acromiotrapezius. Both mm. clavotrapezius and omotransversarius insert at a fibrous junction considered a rudimentary clavicle (Jullien, 1967). Here the two muscles fuse with m. clavodeltoideus to form "m. brachiocephalicus." Typically in aclaviculate eutherians "m. brachiocephalicus" is comprised of mm. cleidomastoideus, clavotrapezius, and clavodeltoideus, whereas in *Potamogale* and paenungulates "m. brachiocephalicus" is comprised of mm. omotransversarius, clavotrapezius, and clavodeltoideus. Also unusual, it appears that the great auricular nerve is emerging proximal to m. clavotrapezius rather than distal. This is very atypical within Mammalia and even within Afrotheria. In *Microgale* and the macroscelidids, for example, the great auricular nerve emerges below m. clavotrapezius. Notably, there is similar confusion over the homologies of mm. cleidomastoideus and clavotrapezius in *Orycteropus*.

M. acromiotrapezius is a vast, robust triangle, and the accessory nerve is visible on its undersurface. It originates from the occiput, ligamentum nuchae, and proximal thoracic vertebrae. Its caudal edge is mingled with m. spinotrapezius, and these muscle fibers insert along the spine of the scapula. However, its cranial end has no fibers of insertion on the spine of the scapula, but rather has a folded appearance there and continues on to insert near the distal end of the greater tuberosity of the humerus. This seems very odd, and it is likely that the folded area, and the slight tendinous intersection on its deep surface, marks the area of fusion of mm. acromiotrapezius and acromiodeltoideus. Thus, the humeral insertion in *Potamogale* rightly belongs to m. acromiodeltoideus, and m. acromiotrapezius has very little bony insertion on the spine of the scapula as the bulk of the muscle fuses with m. acromiodeltoideus. Verheyen (1961) similarly described the middle part of the trapezius being united with deltoideus by muscle fibers and loose connective tissue in *Micropotamogale*.

M. spinotrapezius originates from the first two lumbar vertebrae and inserts on the posterior scapular spine. This is quite typical among afrotherian and lipotyphlan mammals; however, m. spinotrapezius does mingle with the caudal edge of m. acromiotrapezius (Dobson, 1883; Jullien, 1967), and the two muscles are connected into one sheet in *Micropotamogale* (Verheyen, 1961).

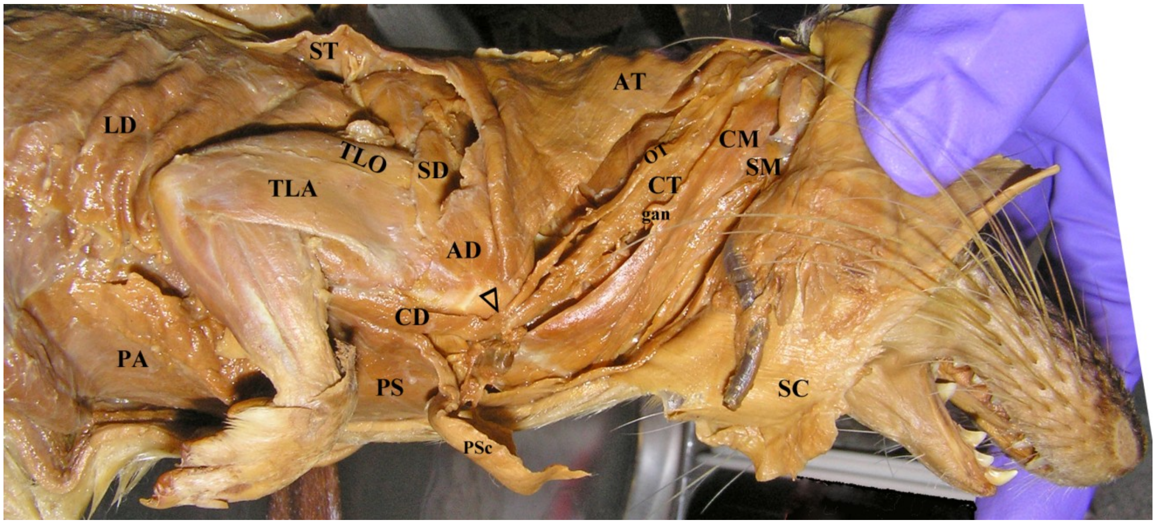


Figure 3.2A-4. Trapezius complex (P2142539). Triangle on greater tuberosity of the humerus points to tendinous intersection (vestigial clavicle).

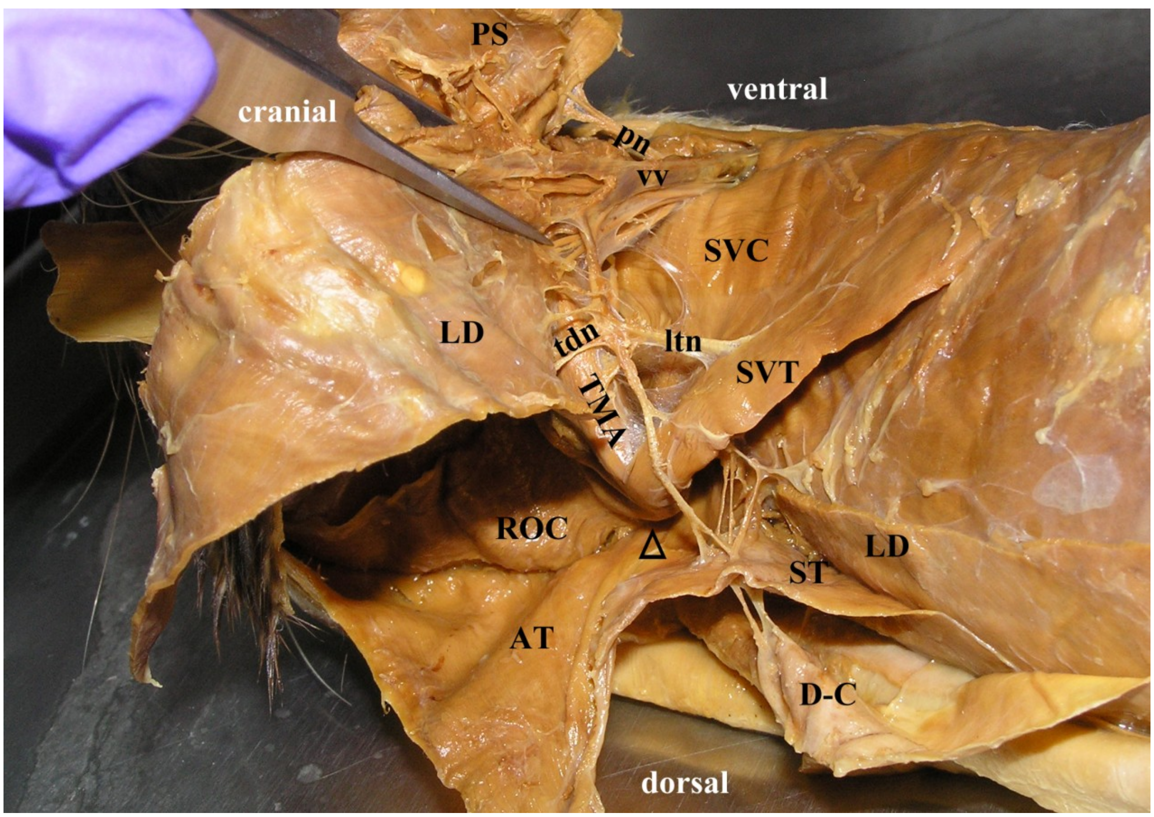


Figure 3.2A-5. Some nerves of the brachial plexus. Thoracodorsal (tdn), long thoracic (ltn), and pectoral nerves (pn), caudo-lateral view (P3132790). Triangle points to caudal angle of scapula.

B. RHOMBOID GROUP – DORSAL SCAPULAR NERVE

mm. rhomboideus (capitis et cervicis et thoracis)

Mm. rhomboideus are fused. The muscle has a robust origin from the midline of the occiput deep to the origin of m. acromiotrapezius and from the cervical and first thoracic vertebrae, where it is more weakly attached. The muscle inserts in a swath from the middle of the scapular spine to the deep surface of the vertebral border of the scapula, and on the surface of the scapula from the base of the spine to the cranial angle.

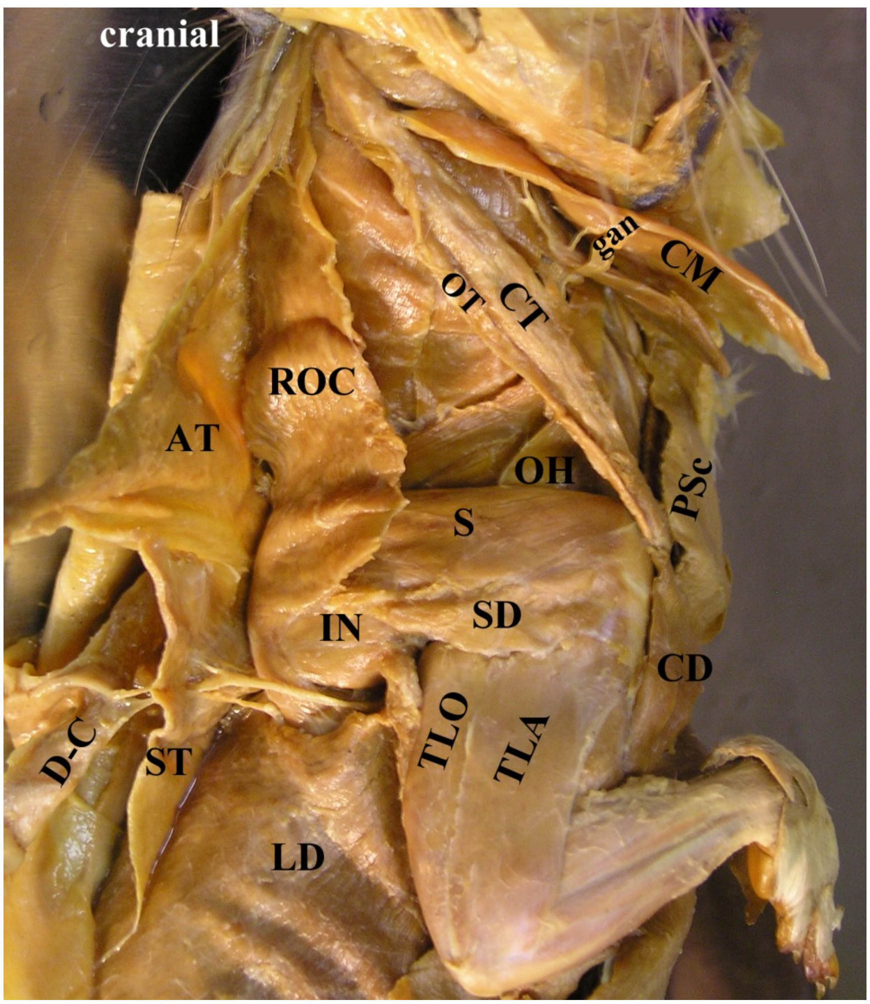


Figure 3.2A-6. Mm. rhomboideus (P3132783).

C. OMO GROUP – CERVICAL NERVES, LONG THORACIC NERVE

mm. omotransversarius, omohyoideus, serratus ventralis (cervicis, thoracis)

M. omotransversarius has been reported absent in *Potamogale* (Jullien, 1967), but in this specimen of *Potamogale* there is a tiny ribbon of muscle passing between mm. clavotrapezius and acromiotrapezius. This ribbon originates around the base of the occiput as a few fascial filaments, and inserts just lateral to m. clavotrapezius on the fibrous junction that represents the vestigial clavicle. Positionally, the insertion seems valid for m. omotransversarius, but the muscle ran parallel to and in the same plane as m. acromiotrapezius rather than deep and perpendicular to it. Verheyen (1961) reported a typically perpendicular m. omotransversarius inserting deep to m. acromiotrapezius on the rostral end of the scapular spine in *Micropotamogale*; nothing of the sort was found in *Potamogale*.

M. omohyoideus is present and inserts on the deep surface of the cranial border of the scapula, between the cranial edges of mm. subscapularis and supraspinatus.

M. serratus ventralis cervicis is visible near the cranial angle of the scapula when the mm. rhomboideus is retracted laterally. Its 3 cm-wide origin from the transverse processes of cervical vertebrae 2-7 is very robust, and the muscle is thick. The muscle inserts along the deep surface of the cranial end of the vertebral border of the scapula. The proximal part is partially separated from the rest of the muscle, and may represent the remnants of a second portion of m. omotransversarius as seen in paenungulates.

The 7 mm-wide m. serratus ventralis thoracis is slight by comparison to m. serratus ventralis cervicis. It originates from ribs 5-7 via three digitations, and inserts on the superficial and deep surfaces of the caudal angle of the scapula. It also fuses with mm. rhomboideus just beyond the spine of the scapula. Verheyen (1961) described an additional portion of m. serratus ventralis thoracis in *Micropotamogale*, from ribs 1-5, also inserting on the deep surface of the caudal end of the vertebral border of the scapula. Similarly, m. serratus ventralis thoracis was comprised of two parts in *Potamogale* (Jullien, 1967), but I did not discern such a distinct additional portion. There is, however, a slip of muscle of unknown origin from the 4th rib which inserts on the deep surface of the insertion of mm. rhomboideus.

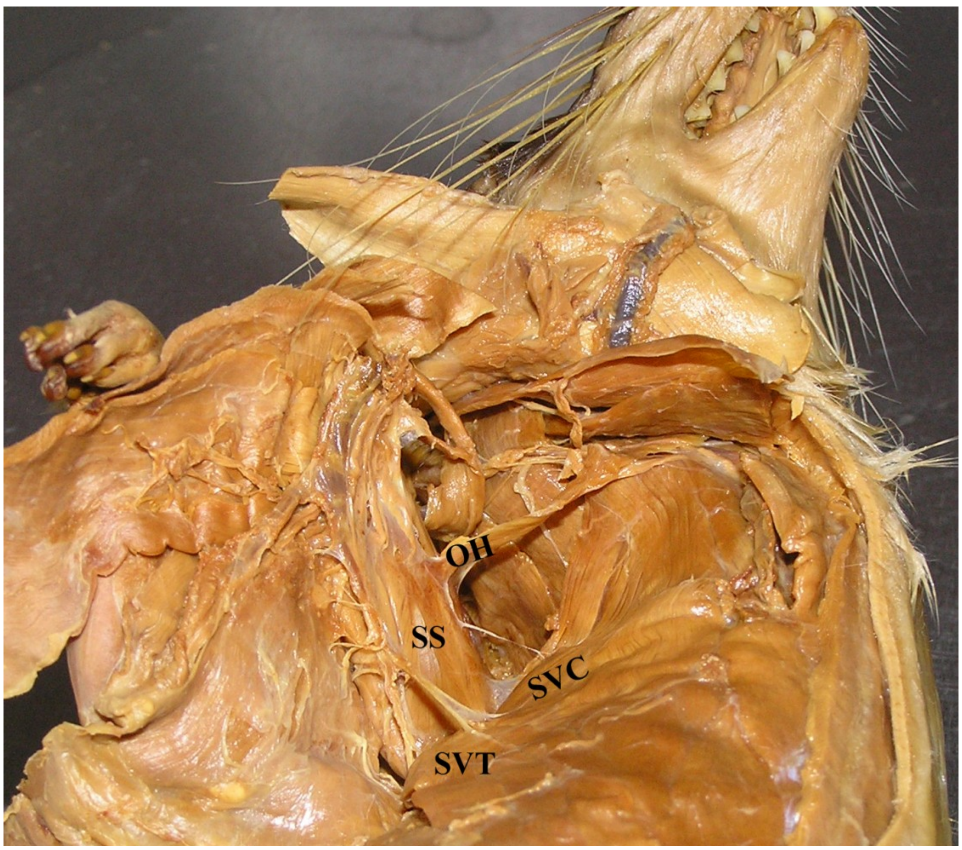


Figure 3.2A-7. M. omohyoideus, lateral view with right forelimb reflected toward the dorsum of the animal (P3132792).

[OH – omohyoideus, SS – subscapularis, SVC – serratus ventralis cervicis, SVT – serratus ventralis thoracis]

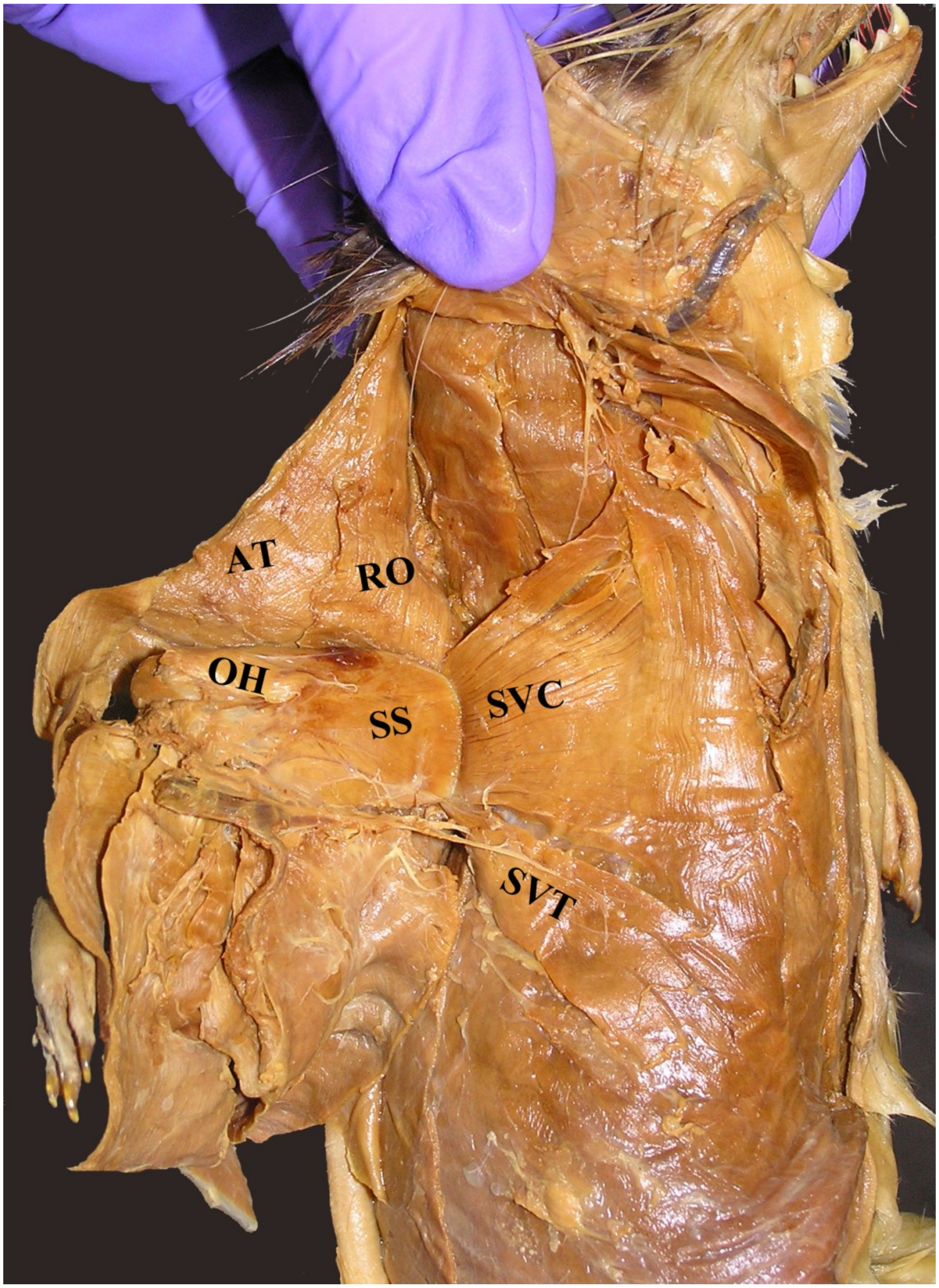


Figure 3.2A-8. Mm. serratus ventralis, lateral view with forelimb reflected to the dorsum of the animal (P3132796)

[AT – acromiotrapezius, OH – omohyoideus, RO – rhomboideus capitis et cervicis, SS – subscapularis, SVC – serratus ventralis cervicis, SVT – serratus ventralis thoracis]

D. DELTOID GROUP – AXILLARY NERVE

mm. clavodeltoideus, acromiodeltoideus, spinodeltoideus, teres minor

Dobson (1883) mistakenly described the portions of mm. deltoideus with the trapezius complex and with mm. pectoralis, thus claiming that the muscle is small in *Potamogale*. However, I consider mm. deltoideus to be a robust muscle complex in *Potamogale*, with some interesting fusions with the trapezius complex.

M. clavodeltoideus originates from a fibrous raphe on the cranial aspect of the shoulder, which Jullien (1967) interpreted as a rudimentary clavicle. This would be consistent with other aclaviculate mammals, especially as mm. clavotrapezius and omotransversarius insert on this fibrous raphe, forming the cranial end of "m. brachio-cephalicus" which often occurs in aclaviculate mammals. M. clavodeltoideus is 4 mm wide and courses just lateral to the clavicular head of m. pectoralis superficialis, partially fusing with it prior to inserting on the distal humerus.

M. acromiodeltoideus is completely fused with m. acromiotrapezius, thus it takes origin from the caudal edge of m. acromiotrapezius over the spine of the scapula where m. acromiotrapezius typically inserts. A faint tendinous line marking the origin of m. acromiodeltoideus is visible on the deep surface of the conjoined muscles. It inserts on the lateral deltopectoral crest. Contraction of m. acromiotrapezius will act to laterally rotate and abduct the humerus, a clear adaptation for swimming.

M. spinodeltoideus originates for 2.2 cm along the caudal edge of the scapular spine, beginning roughly opposite the insertion of mm. rhomboideus. It inserts on the proximal third of the lateral humerus, lateral to the insertion of m. acromiodeltoideus and reaching the base of the greater tuberosity.

Contrary to Dobson (1883), m. teres minor is not absent. It can be seen only when m. infraspinatus is removed from the infraspinous fossa and thus may have been overlooked by Dobson, or may not always be present. M. teres minor is a tiny triangular muscle about 1 cm long, made up of a single layer of delicate muscle fibers. It originates from the neck of the scapula at the level of the acromion process, deep to m. infraspinatus and superficial to the origin of m. triceps brachii caput longum. It inserts on the caudo-lateral side of the greater tuberosity, distal and caudal to the insertion of m. infraspinatus and just proximal to the origin of m. triceps brachii caput laterale.

The axillary nerve travels between mm. teres major and subscapularis with the posterior humeral circumflex artery, emerging between the mm. triceps brachii and infraspinatus to enter the portions of mm. deltoideus.

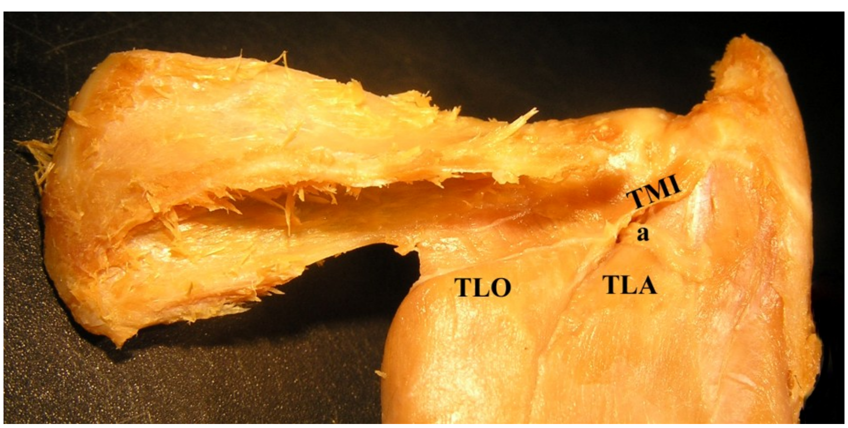
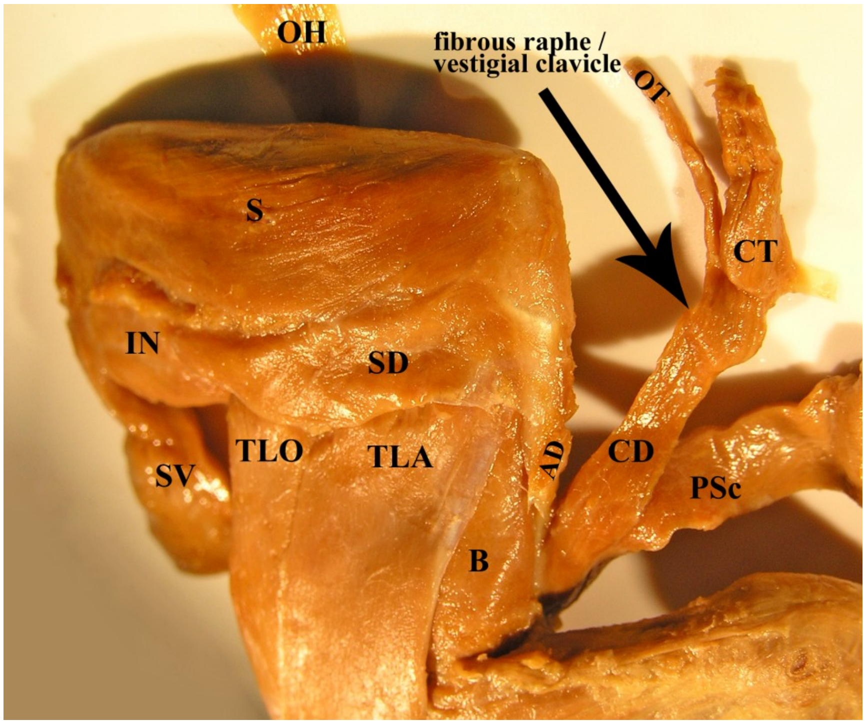
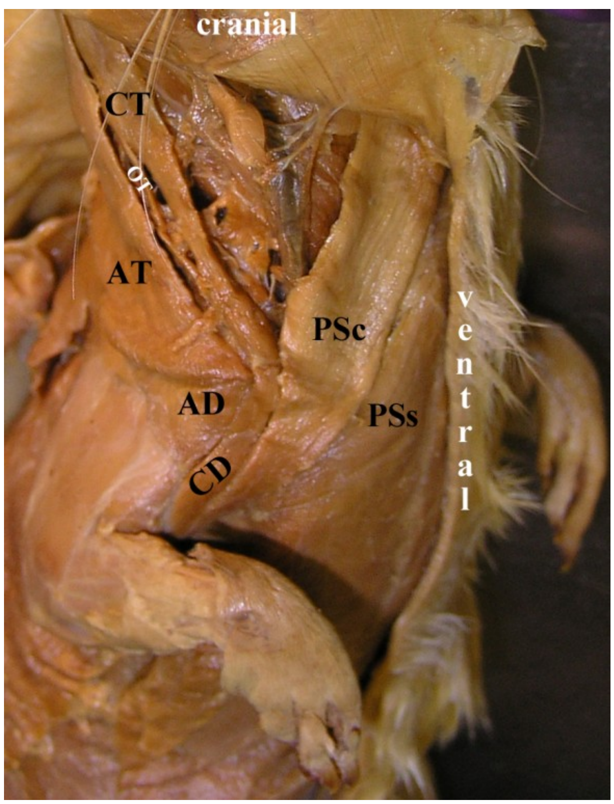


Figure 3.2A-9. M. teres minor, visible after infraspinatus is removed (P1014635)

[a – axillary nerve, TLA – triceps brachii caput laterale, TLO – triceps brachii caput longum, TMI – teres minor]

A. 

B. 

AD – acromiodeltoideus,
AT – acromiotrapezius,
B – brachialis,
CD – clavodeltoideus,
CT – clavotrapezius,
PSc – clavicular portion pectoralis superficialis,
PSs – superficial portion pectoralis superficialis,
OH – omohyoideus,
OT – omotransversarius,
S – supraspinatus,
SD – spinodeltoideus,
SV – serratus ventralis,
TLA – triceps brachii caput laterale,
TLO – triceps brachii caput longum

Figure 3.2A-10. Mm. deltoideus
A. Lateral view, m. acromiodeltoideus removed (P7233964). B. Ventral view, all muscles intact (PA192315).

E. SUBSCAPULARIS GROUP – SUBSCAPULAR NERVE

mm. subscapularis, teres major

M. subscapularis fills the entire subscapular fossa. It originates as two main bundles of fibers split by the subscapular nerve. The two bundles converge to a very stout tendon which lies deep to m. coracobrachialis, separated by a bursa. It inserts on the lesser tuberosity of the humerus.

M. teres major is fleshy and thick. It originates for 1.4 cm along the superficial surface and for 9 mm along the deep surface of the caudal border of the scapula. The muscle fuses with m. latissimus dorsi a few millimeters prior to insertion on the medial surface of the humerus deep to the muscle belly of m. biceps brachii, but their separate tendons remain distinct with m. teres major inserting more cranially.

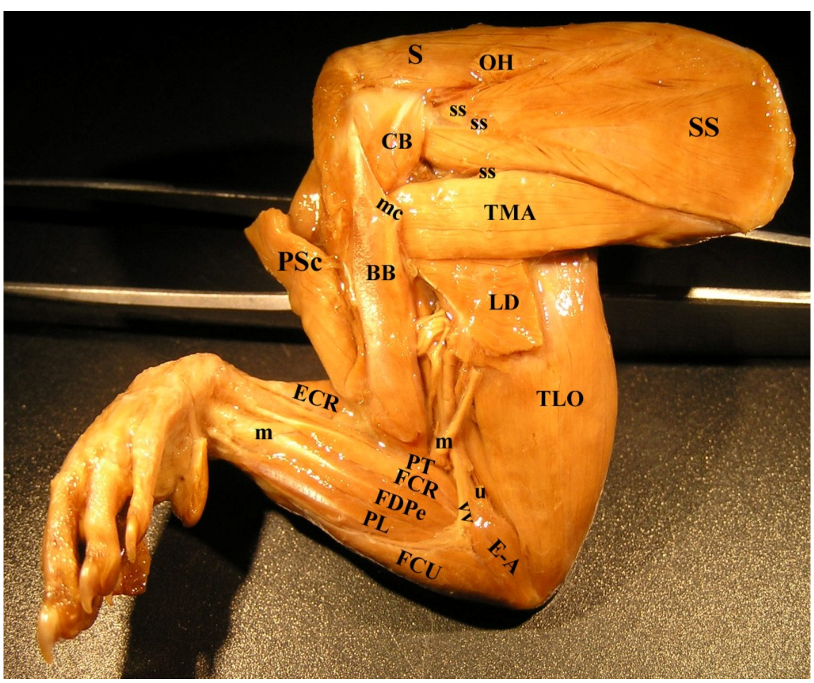
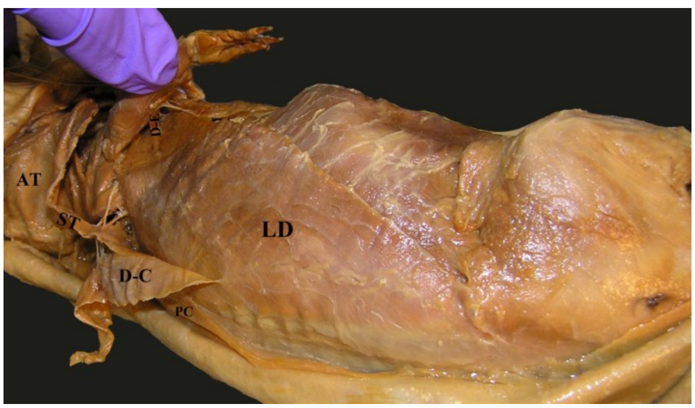


Figure 3.2A-11. Mm. teres major and subscapularis (P8104414)

F. LATISSIMUS GROUP – THORACODORSAL NERVE

m. latissimus dorsi

M. latissimus dorsi is an impressive muscle lying deep to m. dorsocutaneous, which covers its proximal third. It originates for 9 cm along most of the thoracic vertebrae, the proximal five lumbar vertebrae, and the thoracolumbar fascia. The muscle is split into two portions; the larger dorsal piece fuses with m. teres major and inserts on the medial humerus deep to m. biceps brachii, and the smaller ventral piece inserts via tendinous fibers on the caudal edge of m. pectoralis profundus in the medial arm.

A.


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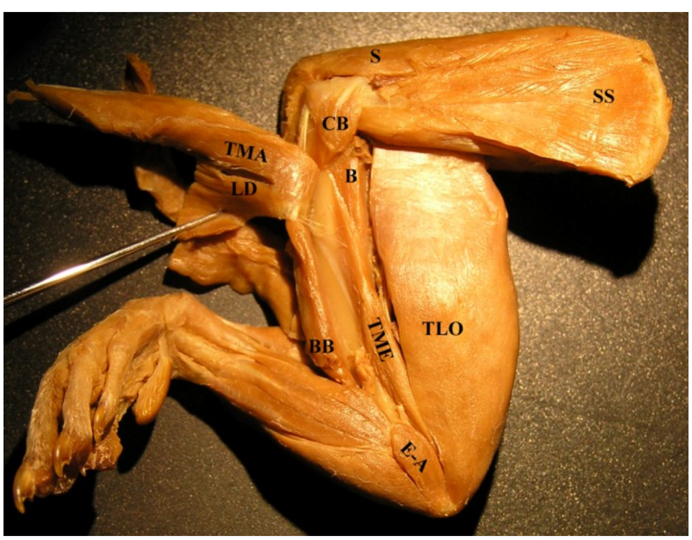


Figure 3.2A-12. M. latissimus dorsi

A. Dorsal view showing origin of m. dorso-epitrochlearis from m. latissimus dorsi (P3122748). B. Insertion of mm. latissimus dorsi and teres major, medial view (P8104449).

[AT – acromiotrapezius, B – brachialis, BB – biceps brachii, CB – coracobrachialis, D-C – dorso-cutaneous, E-A- epitrochlear-anconeus, LD – latissimus dorsi, S – supraspinatus, SS – subscapularis, TLO – triceps brachii caput longum, TMA – teres major, TME - triceps brachii caput mediale]

G. PECTORALS GROUP – PECTORAL NERVES

mm. pectoralis superficialis (clavicular, superficial, and deep portions), pectoralis profundus, pectoralis abdominalis, subclavius, sternoscapularis

M. pectoralis superficialis is divided into three portions. The clavicular portion of m. pectoralis superficialis originates for 1.5 cm along the ventral midline raphe in the neck and from the surface of the superficial portion of m. pectoralis superficialis. It narrows to a width of 4 mm and inserts for 9 mm along the distal end of the deltopectoral crest, deep to and partially fused with m. clavodeltoideus. As reported here, there is a similar clavicular portion of m. pectoralis superficialis originating from the manubrium in the claviculate afrosoricids *Calcochloris* and *Microgale*. This portion appears to share innervation with the other two portions of m. pectoralis superficialis.

The superficial portion of m. pectoralis superficialis originates for 1 cm on the manubrium deep to the clavicular portion of m. pectoralis superficialis. It has a 7 mm-wide insertion on the humerus medial to the insertion of mm. deltoideus and lateral to the insertion of the deep portion of m. pectoralis superficialis. It is smaller than the deep portion and very thin. The broader, triangle-shaped sheet is the deep portion of m. pectoralis superficialis. The fibers are directed fairly straight across the thorax, from the 4 cm-wide origin along the manubrium and sternum to a 1.8 cm-wide insertion along a small ridge on the cranial surface of the humerus. It inserts deep to the superficial portion of m. pectoralis superficialis.

M. pectoralis profundus may be fused with m. sternoscapularis, which is otherwise absent in *Potamogale* and other tenrecs (Jullien, 1967). The pectoralis profundus muscle layer is the deepest layer of the pectoralis complex, covered by mm. pectoralis superficialis on its proximal third and m. pectoralis abdominalis on its caudal third. It is extremely broad and originates for 7 cm on the ventral midline. The more cranial and medial fibers insert via fleshy fibers along the medial side of the greater tuberosity of the humerus. At the greater tuberosity some fibers may extend over the surface of m. supraspinatus, as is typical for m. sternoscapularis. The caudal and lateral edge of the muscle appears to be somewhat rolled upon itself and inserts on the humerus to midshaft. The total length of the insertion is 1.3 cm.

M. pectoralis abdominalis is a flimsy muscle whose fibers are interconnected with those of m. latissimus dorsi, and shares innervation from the thoracodorsal nerve. It has a 2 mm-wide insertion on the cranial aspect of the deltopectoral crest, deep to mm. pectoralis superficialis and distal to the insertion of m. pectoralis profundus.

Jullien (1967) claims both mm. subclavius and sternoscapularis are absent. However, as described above, m. sternoscapularis may be fused with m. pectoralis profundus. I did not observe m. subclavius.

Figure 3.2A-13. Mm. pectoralis, ventral view (P3132774)

[CD – clavodeltoideus, PA – pectoralis abdominalis, PSc – clavicular portion of pectoralis superficialis, PSd – deep portion of pectoralis superficialis, PSs – superficial portion of pectoralis superficialis]

Figure 3.2A-14. Mm. deltoideus and pectoralis inserting on the humerus

A. Muscles intact. B. M. clavodeltoideus and clavicular portion of m. pectoralis superficialis. C. Superficial portion of m. pectoralis superficialis. D. Deep portion of m. pectoralis superficialis. E. M. pectoralis profundus. F. M. pectoralis abdominalis.

[AD – acromiodeltoideus, AT – acromiotrapezius, CD – clavodeltoideus, LD – latissimus dorsi, OH – omohyoideus, PA – pectoralis abdominalis, PP – pectoralis profundus, PSc – clavicular head of pectoralis superficialis, PSd – deep portion of pectoralis superficialis, PSs – superficial portion of pectoralis superficialis]

H. BICEPS GROUP – MUSCULOCUTANEOUS NERVE

mm. coracobrachialis, biceps brachii, brachialis

M. coracobrachialis is a small triangular muscle which originates from the small coracoid tubercle projecting above the medial side of the glenoid fossa. The muscle crosses the tendon of insertion of m. subscapularis, and inserts via fleshy fibers on the medial surface of the humerus. It inserts deep to the belly of m. biceps brachii just proximal to the joint insertion of mm. teres major and latissimus dorsi.

M. biceps brachii originates via a 2 mm-wide tendon from a flattened projection above the glenoid fossa. The tendon exits the glenohumeral joint capsule by travelling deep to the strong transverse humeral ligament. The tendon gives way to a fleshy fusiform belly which covers the cranial surface of the humerus, with mm. pectoralis and deltoideus inserting lateral to it. Its tendon of insertion divides to surround the tendon of m. brachialis; the larger and more medial tendon inserting on the medial ulna, and the smaller more lateral tendon inserting on the caudo-medial neck of the radius.

M. brachialis has two heads of origin, from the caudo-medial and lateral sides of the humerus just distal to the joint capsule. The lateral head originates from the base of the greater tubercle where mm. infraspinatus and teres minor insert, and extends down the lateral aspect of the deltopectoral crest deep to the origin of m. triceps brachii caput laterale. The medial head originates deep to m. coracobrachialis. The two heads fuse after 6 mm and the muscle sweeps laterally around the middle of the humeral shaft. M. brachialis inserts on the medial surface of the ulna after passing through the divided tendon of m. biceps brachii.

A. B. C. D.

Figure 3.2A-15. Muscles of the biceps group
A. Medial view. B. Caudal view (P1010028). C. Insertions, medial view. D. Origins, medial view.

I. SPINATI GROUP – SUPRASCAPULAR NERVE

mm. supraspinatus, infraspinatus

M. supraspinatus is quite large, more than twice as wide as m. infraspinatus. It originates from the entire supraspinous fossa and the cranial edge of the scapular spine, also extending above the cranial margin of the scapula to originate from m. subscapularis. It inserts via robust fleshy and tendinous fibers on the cranial, lateral, and medial sides of the greater tuberosity, opposite the insertion of m. pectoralis profundus. It covers the origin of m. coracobrachialis.

M. infraspinatus is much smaller than m. supraspinatus, and is only 4 mm wide. It originates from the infraspinous fossa and the caudal surface of the scapular spine. It inserts via tendon on the caudo-lateral surface of the greater tuberosity, distal and caudal to the insertion of m. supraspinatus.

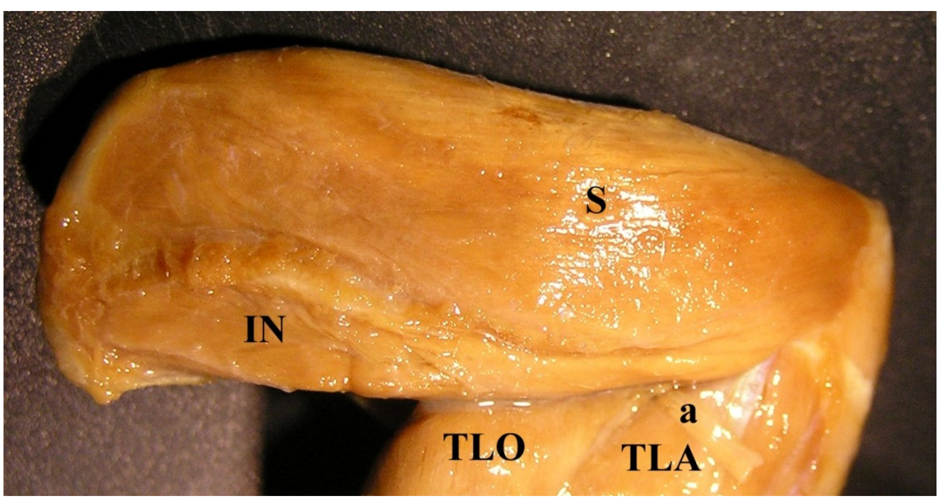


Figure 3.2A-16. Mm. supraspinatus and infraspinatus, lateral view (P1014614).

[a – axillary nerve, IN – infraspinatus, S – supraspinatus, TLA – triceps brachii caput laterale, TLO – triceps brachii caput longum]

J. TRICEPS GROUP – RADIAL NERVE

mm. dorso-epitrochlearis, triceps brachii (caput laterale, caput mediale, caput longum), anconeus

M. dorso-epitrochlearis is a 4 mm-wide strip of muscle given off via fleshy fibers from the dorsal aspect of m. latissimus dorsi where it crosses behind the medial humerus. It inserts on the medial olecranon. It is much less robust than m. dorsoepitrochlearis in other afrotheres such as *Orycteropus* and *Calcochloris*.

M. triceps brachii caput laterale is 9 mm wide with two origins: a 3mm band of translucent tendinous fibers from the lateral humerus, and a larger tendon from the caudo-lateral humerus. It inserts on the lateral surface of the olecranon fused with m. triceps brachii caput longum, and extends down the lateral side of the ulna superficial to the other muscles. Mm. triceps brachii caput laterale and triceps brachii caput longum are separated proximally by the axillary nerve.

M. triceps brachii caput longum originates for 1.1 cm along the neck and caudal border of the scapula. M. triceps brachii caput longum is a thick single belly covering the caudal and most of the medial surface of the arm; the only evidence of separation within the muscle as seen in several other afrotheres is where vessels enter the caudal edge of the muscle. It inserts mainly on the tip of the olecranon, but also extends around the medial and lateral sides of the olecranon. A thickening in the tendon of insertion glides over the cranial edge of the tip of the olecranon. This is similar to the sesamoid-like cartilage seen in the tendon of insertion of mm. triceps brachii of macroscelidids.

M. triceps brachii caput mediale originates for 2 cm along the caudo-medial surface of the humerus, beginning just distal to the belly of m. coracobrachialis and ending on the caudal surface of the medial epicondyle. M. brachialis is visible lateral to its proximal end. A plane through the muscle reveals it is separate from m. anconeus, which is deep, but the two muscles are fused laterally and insert together on the entire cranial surface of the olecranon.

M. anconeus originates deep to m. triceps brachii caput mediale and is fused with its lateral edge. They insert together on the cranial surface of the olecranon, with m. anconeus also extending down the lateral side of the olecranon. The radial nerve passes in the groove between mm.anconeus and brachialis.

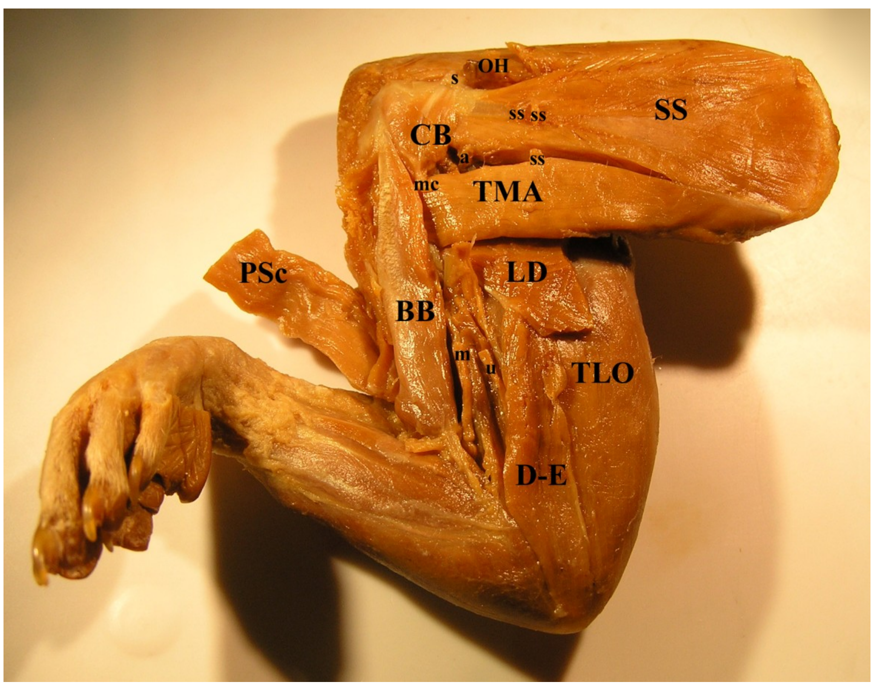
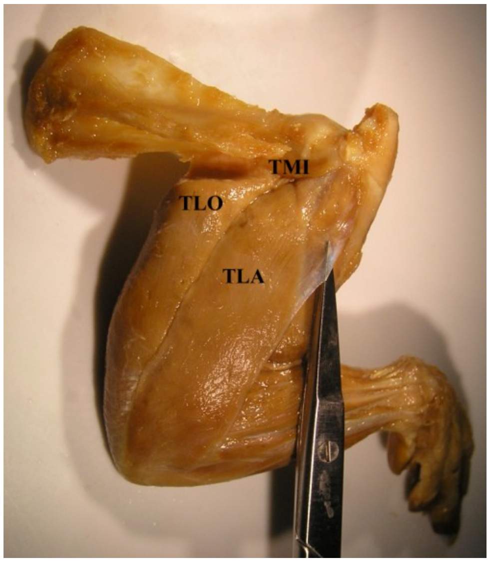
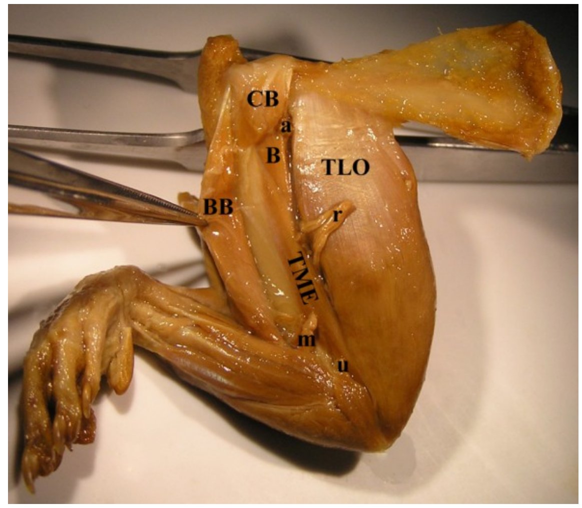


Figure 3.2A-17. M. dorso-epitrochlearis, medial view (P7233969).

A. 

B. 

C. 

Figure 3.2A-18. Mm. triceps brachii.
A. Lateral view (P1014651) B. Medial view (P1014650). C. Deep medial view (P1014671).

[B – brachialis, BB – biceps brachii, CB – coracobrachialis, CD – clavodeltoideus, D-E- dorso-epitrochlearis, OH – omohyoideus, LD – latissimus dorsi, m – medial nerve, PSc – clavicular portion of pectoralis superficialis, r – radial nerve, ss – subscapular nerve, SS – subscapularis, TLA – triceps brachii caput laterale, TLO – triceps brachii caput longum, TME – triceps brachii caput mediale, TMI – teres minor, u – ulnar nerve]

K. EXTENSOR GROUP – RADIAL NERVE

mm. brachioradialis, extensors carpi radialis, extensor digitorum communis, extensor digitorum lateralis, extensor carpi ulnaris, supinator, abductor pollicis longus, extensor digitorum profundus

M. brachioradialis is absent, or fused with the lateral head of m. brachialis.

M. extensor carpi radialis is a large, single belly which originates from the lateral supracondylar crest. It has two distal tendons which insert into the base of metacarpals II and III. The superficial radial nerve travels along the surface of m. extensor carpi radialis into the dorsum of the manus. The manus is thickly coated with fat and fascia, making the superficial radial nerve difficult to trace, but it seems to provide innervation to the dorsal surface of digits I-III.

M. extensor digitorum communis originates for 2.5 mm along the proximal margin of the lateral epicondyle. Its belly is broader than the other muscles originating from the lateral epicondyle. It passes deep to the extensor retinaculum and inserts as broad expansions over digits II-V. The tendons are interconnected with each other and with the tendons of mm. extensor digitorum lateralis and extensor digitorum profundus.

M. extensor digitorum lateralis originates for 1.5 mm from the caudal edge of m. extensor digitorum communis via a small slip and from the lateral epicondyle just distal to m. extensor digitorum communis. It travels deep to the extensor retinaculum and inserts on digits IV and V. The tendon for digit IV crosses deep to the tendon of m. extensor digitorum communis for digit V.

M. extensor carpi ulnaris originates for 3 mm along the intermuscular septum superficial to m. flexor digitorum profundus and from the distal margin of the lateral epicondyle. The muscle inserts on the lateral carpus and the base of metacarpal V.

M. supinator is a tiny cylindrical belly which originates from the cranial surface of the lateral epicondyle, medial to the origin of m. extensor digitorum communis and just proximal to the origin of m. extensor carpi ulnaris. It is fleshy for 1.2 cm and then becomes a tendon that fuses with the superficial surface of the tendon of m. abductor pollicis longus a few millimeters before the carpus. Thus, the muscle supinates via the tendon of m. abductor pollicis longus.

M. abductor pollicis longus originates via two heads. One originates from the lateral ulna deep to the origin of m. extensor digitorum profundus, and the other from the lateral surface of the head of the radius. The two portions fuse and the muscle has a broad, flat central tendon on which the belly of m. extensor digitorum profundus glides. The tendon becomes continuous with the flexor retinaculum and inserts mainly on a small, ovoid, cartilaginous sesamoid at the medial (radial) edge of the manus and on the medial side of the base of metacarpal I. The tendon of m. abductor pollicis longus also contains a radial sesamoid bone or vestigial metacarpal I in the aardvark and hyracoids.

M. extensor digitorum profundus originates in a curve for 5 mm along the lateral surface of the ulna, just below the humeral-ulnar joint. It is superficial to m. abductor pollicis longus and glides on the surface of that muscle. M. extensor digitorum profundus is fleshy for 1.1 cm as it crosses deep to mm. extensor carpi ulnaris, extensor digitorum lateralis, and extensor digitorum communis. It emerges as a tendon that crosses superficial to m. extensor carpi radialis, travelling lateral and parallel to the tendon of m.

abductor pollicis longus. The tendon splits to insert down the center of the dorsal surface of digit 1 and along the medial side of digit II.

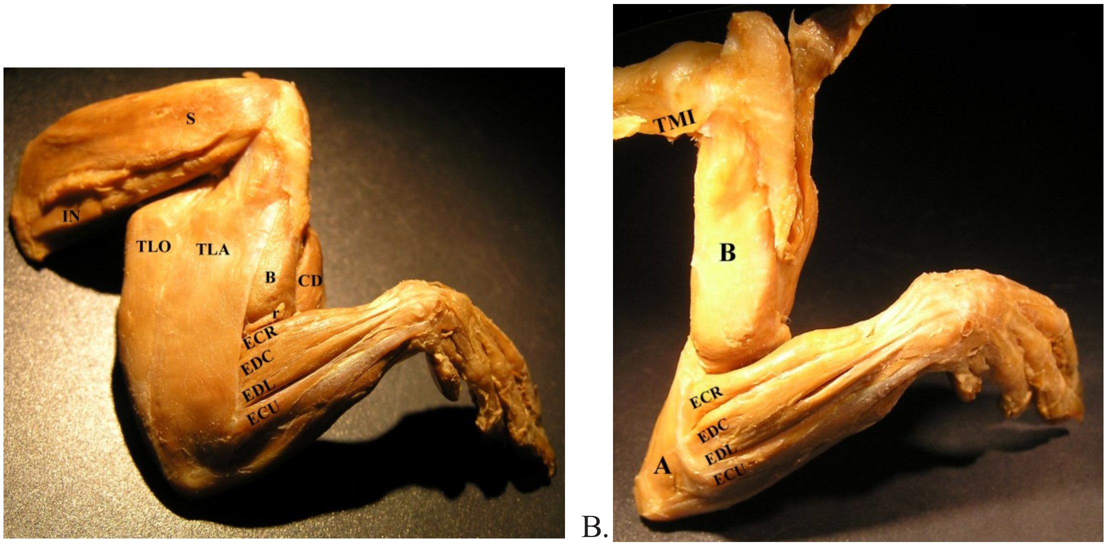
A. 
B.

Figure 3.2A-19. Muscles originating from the lateral epicondyle.

A. With mm. triceps brachii intact (P8104473). B. With mm. triceps brachii removed (P1010010).

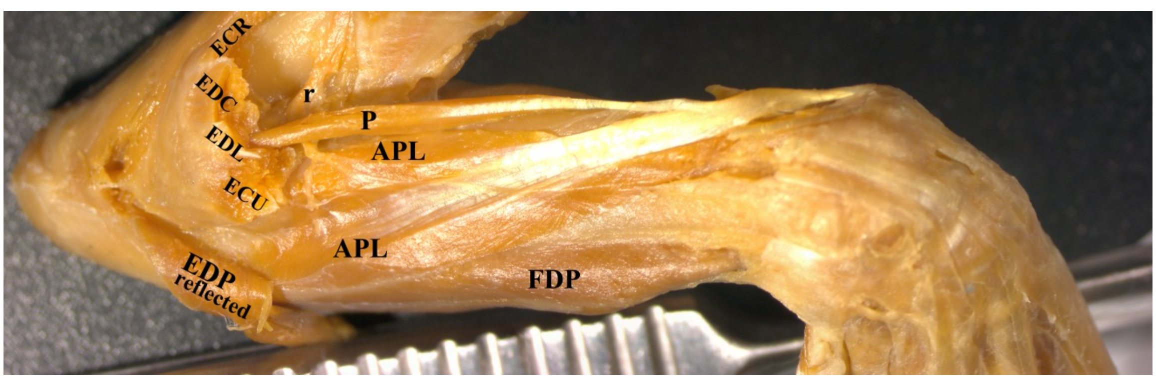
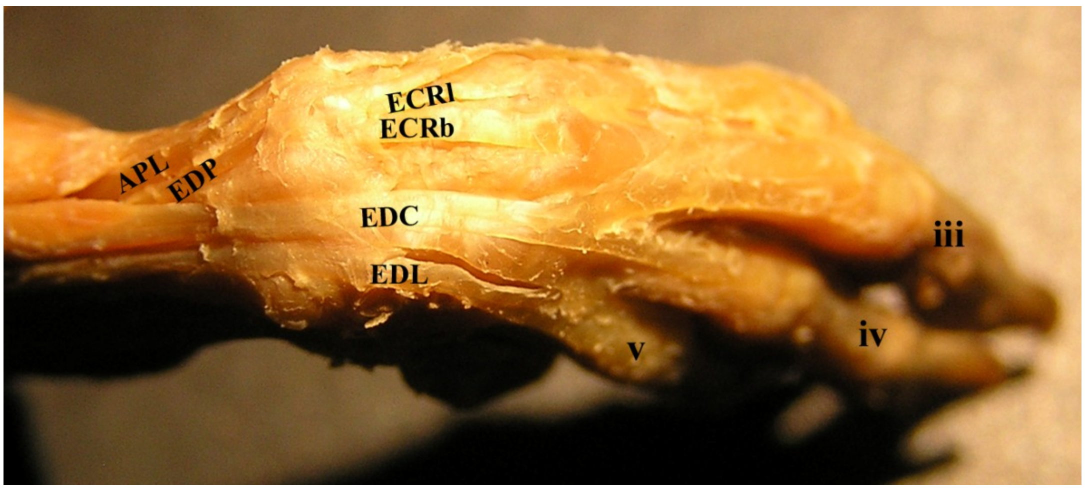


Figure 3.2A-20. M. abductor pollicis longus, lateral view. M. extensor digitorum profundus is reflected.

[APL – abductor pollicis longus, B – brachialis, CD – clavodeltoideus, ECR – extensor carpi radialis, EDC – extensor digitorum communis, EDL – extensor digitorum lateralis, EDP – extensor digitorum profundus, FDP – flexor digitorum profundus, IN – infraspinatus, P – supinator, r – radial nerve, S – supraspinatus, TLA – triceps brachii caput laterale, TLO – triceps brachii caput longum, TMI – teres minor]

A.



B.

C.

Figure 3.2A-21. Extensor tendons in the manus

A. Medial view (P8104480). B. Dorsal view (P8104458). C. Lateral view (P8104461).

L. FLEXOR GROUP – MEDIAN and ULNAR NERVES

pronator teres^{m}, flexor carpi radialis^{m}, palmaris longus^{u}, flexor digitorum superficialis^{m}, flexor digitorum profundus^{m+u}, flexor carpi ulnaris^{u}, epitrochleo-anconeus^{u}, pronator quadratus^{m}

M. pronator teres has the most proximal origin from the medial epicondyle. The muscle is a fleshy band 2 mm wide and 1.6 cm long. Tendinous fibers appear on its lateral edge, and it inserts into the medial side of the crest on the cranial surface of the distal third of the radius, deep to the tendon of m. extensor carpi radialis.

M. flexor carpi radialis originates from the medial epicondyle just distal to m. pronator teres. The muscle is fleshy for 1.5 cm, then it becomes tendinous and passes deep to a fibrous retinaculum on the caudo-medial aspect of the radius. The tendon inserts on the palmar base of metacarpal II. This agrees with Dobson's (1883) observations, but Jullien (1967) reported insertion on the base of metacarpal III.

M. flexor digitorum superficialis is unusual. It originates from the middle of the distal part of the superficial epicondylar belly of m. flexor digitorum profundus. It is comprised of wispy fleshy fibers for about 1 cm, and then a few tenuous tendinous condensations appear. One slim tendon solidifies and travels through the palm to insert on the lateral side of the metacarpophalangeal joint of digit III, deep to some unidentified hard tissue in the skin of the palm which may have been a gland. Cutaneous eccrine glands are found in the foot pads of *Echinops* (Stumpf et al., 2004). There are no other tendons of m. flexor digitorum superficialis. No tendons were noted by Jullien (1967).

M. palmaris longus is very large and fleshy and originates from the medial epicondyle surrounded by the origin of the superficial epicondylar belly of m. flexor digitorum profundus. It coalesces to a central tendon and then over the lateral carpus it re-expands as the palmar aponeurosis. It is also attached to the flexor retinaculum which stretches from the base of the pisiform to the radius. M. palmaris longus of *Potamogale* is almost identical to the m. palmaris longus in *Orycteropus*.

The median nerve emerges in the forearm from between mm. flexor carpi radialis and flexor digitorum profundus, then crosses the carpus deep to the flexor retinaculum. It sends a branch to the m. contrahens on the medial side of digit V and appears to send a branch to the lateral side of digit IV. This is similar to the distribution of the sensory branches of the median nerve in the palm of *Orycteropus*.

M. flexor digitorum profundus has four heads of origin. The superficial epicondylar belly of m. flexor digitorum profundus (FDPe) originates in a broad U-shape on the caudal surface of the medial epicondyle, surrounding the origin of m. palmaris longus. This is very similar to the superficial epicondylar belly in *Orycteropus*. The part of the superficial epicondylar belly originating proximal to m. palmaris longus receives a branch of the median nerve. It is fleshy for 1.5 cm and then divides along its central tendon. The medial half sends a small tendon that dives deep and inserts on the ligaments at the trapezium. The lateral half fuses with the part of the muscle originating distal to m. palmaris longus, so the two parts are fused for almost their entire length. The part of the superficial epicondylar belly originating distal to the origin of m. palmaris longus lies deep to the ulnar nerve where it passes behind the medial epicondyle. The origin is fleshy, but the muscle is coated in shiny tendon on which m. palmaris longus glides. The 2.5 mm-wide muscle remains fleshy until just proximal to the carpus, where it forms much of the conjoined flexor tendon as it fuses with the deep epicondylar belly of m. flexor digitorum profundus.

The deep epicondylar belly of m. flexor digitorum profundus (FDPd) originates for 2.5 mm from the medial epicondyle deep to the superficial epicondylar belly. It becomes tendinous after 1.1 cm, and about 5 mm proximal to the carpus it fuses with the medial edge of the tendon of the superficial epicondylar belly. It receives a branch of the median nerve.

The ulnar belly of m. flexor digitorum profundus (FDPu) originates from the distal two-thirds of the caudal and medial surfaces of the ulna and from the edge of m. pronator quadratus. It inserts on the deep surface of the conjoined epicondylar tendons.

The radial belly of m. flexor digititorum profundus (FDPr) is small and almost confluent with the ulnar portion. It originates via fleshy fibers from the medial surface of the radius near midshaft, and remains fleshy on the deep surface of the conjoined tendons of the epicondylar and ulnar heads.

At the carpus, the thick, conjoined tendon of m. flexor digitorum profundus travels deep to the flexor retinaculum. In the palm the conjoined tendon splits, with one tendon to the distal each of digits I-V.

M. flexor carpi ulnaris has only an ulnar head of origin; the epicondylar origin is absent. This is also the case in chrysochlorids and *Orycteropus* (Galton, 1870; Parsons, 1901; Jullien, 1967; Gasc et al., 1986). The muscle originates from the medial side of the olecranon and caudo-medial edge of the ulna. It is fleshy for 2.1 cm then abruptly narrows. It inserts on the pisiform via a strong tendon.

M. epitrochleo-anconeus is 1 cm long and narrower than the same muscle in macroscelidids. It originates from the caudal aspect of the medial epicondyle opposite m. pronator teres. It inserts on the medial surface of the olecranon deep to the insertion of m. dorso-epitrochlearis.

The ulnar nerve passes deep to m. epitrochleo-anconeus, curving around the edge of the medial epicondyle. It travels through the forearm along the deep surface of m. flexor carpi ulnaris, and crosses the carpus medial to the pisiform in a groove superficial to the flexor retinaculum. In the manus it travels over the medial edge of m. abductor digiti minimi and sends a branch to m. palmaris brevis along the deep surface of the ulnar sesamoid, and one to m. flexor digitorum brevis manus for digit V. It also sends sensory branches to the lateral and medial sides of digit V and the lateral side of digit IV.

M. pronator quadratus spans the interosseous space of the middle third of the forearm. Proximal to the muscle are the insertions of mm. biceps brachii and brachialis, and distal to the muscle are the origins of the radial and ulnar heads of m. flexor digitorum profundus.

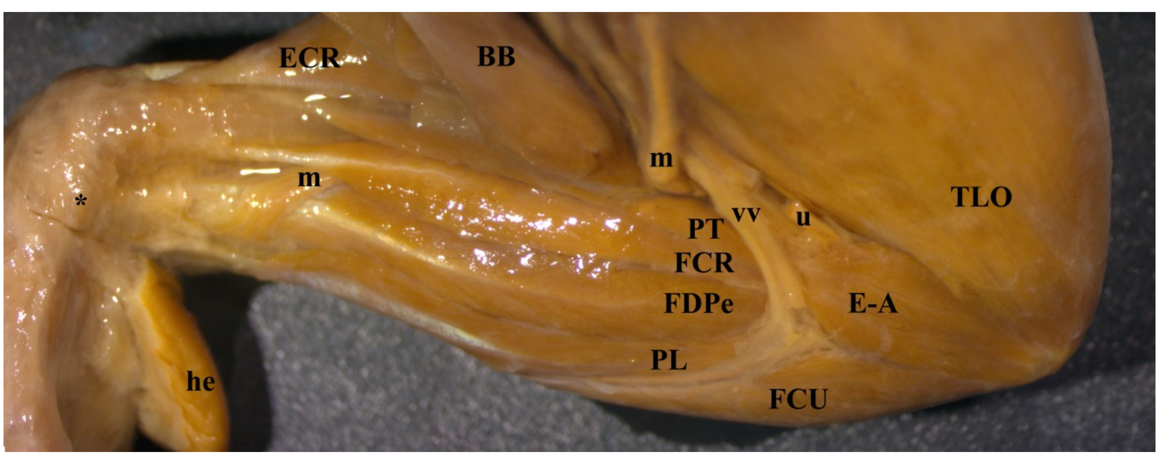
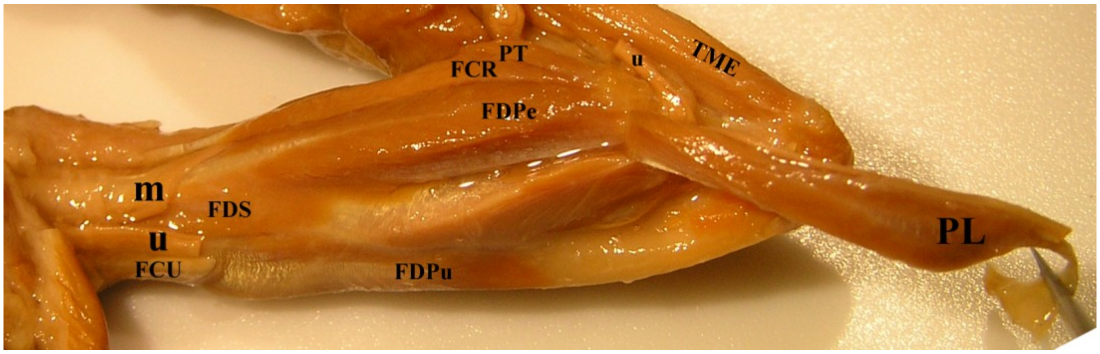


Figure 3.2A-22. Muscles originating from the medial epicondyle, medial view



A.

B.

Figure 3.2A-23. M. palmaris longus.

A. Origin with the superficial epicondylar head of m. flexor digitorum profundus, caudo-medial view (P1010068). B. Insertion.

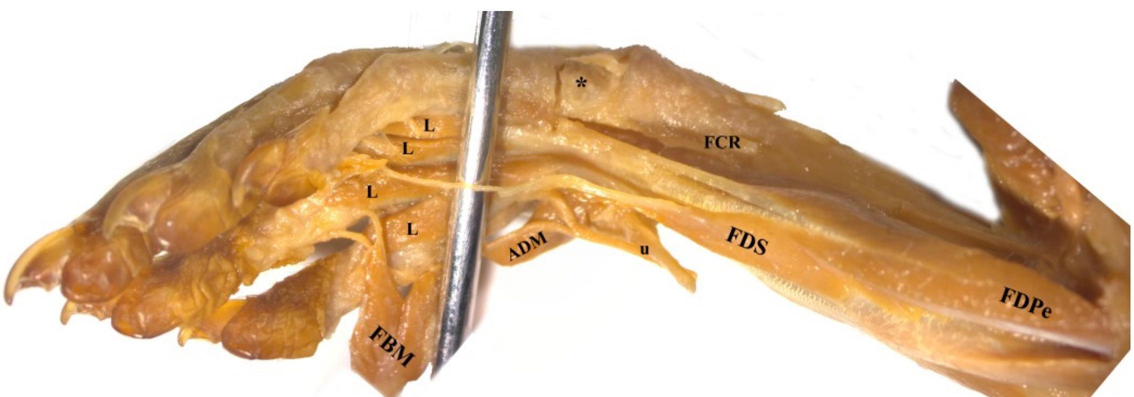


Figure 3.2A-24. M. flexor digitorum superficialis. Single tendon for digit III superficial to probe.

[* - radial sesamoid, ADM – abductor digiti minimi, FBM – flexor digitorum breves manus, FCR – flexor carpi radialis, FCU – flexor carpi ulnaris, FDPe – superficial epicondylar head of flexor digitorum profundus, L – lumbricales, m – median nerve, PL – palmaris longus, PT – pronator teres, TME – triceps brachii caput mediale, u – ulnar nerve]

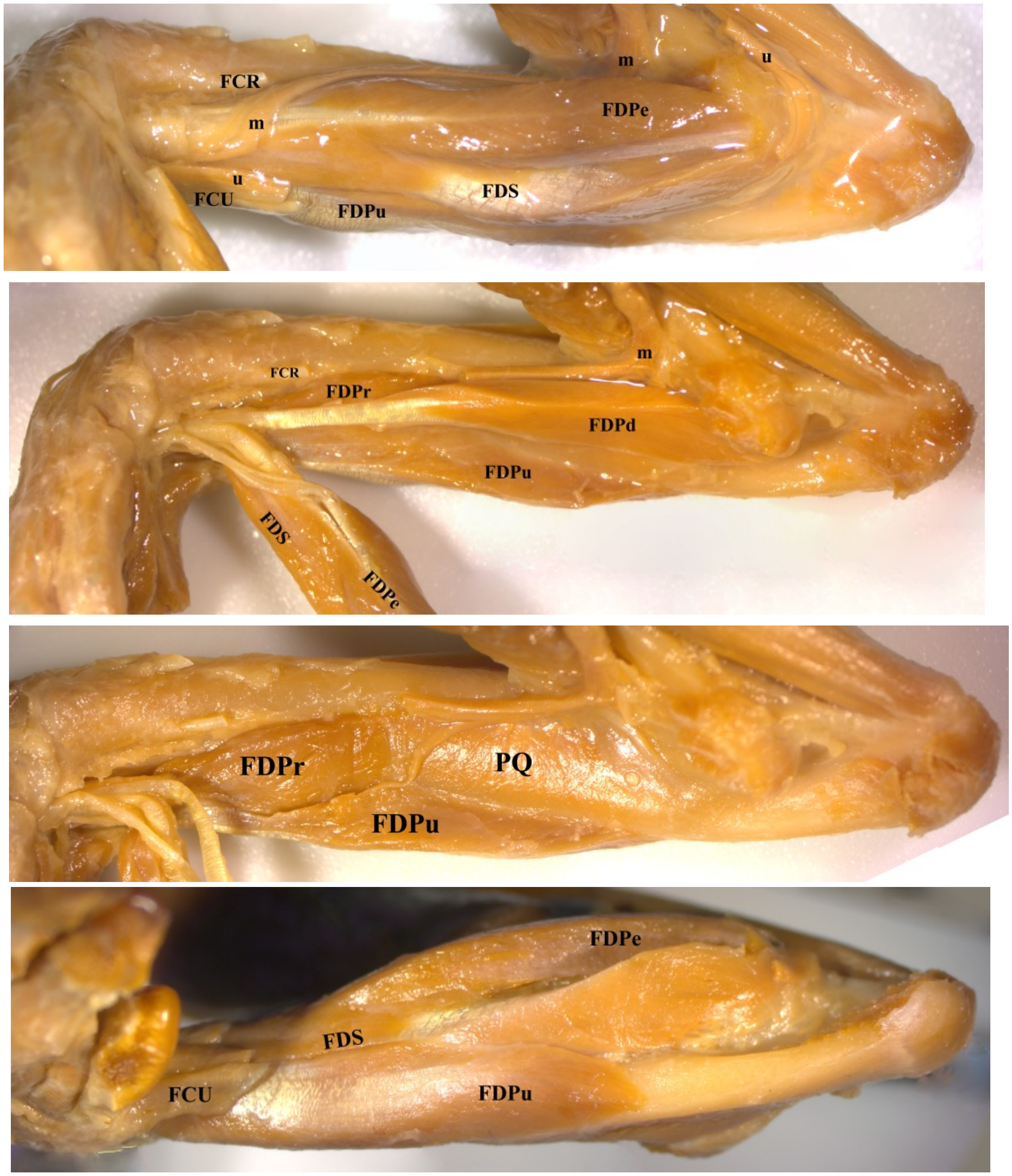


Figure 3.2A-25. M. flexor digitorum profundus.

A. Superficial epicondylar belly, medial view. B. Deep epicondylar belly, medial view. C. Radial and ulnar bellies, deep medial view. D. Ulnar belly, caudal view.

[FCR – flexor carpi radialis, FCU – flexor carpi ulnaris, FDS – flexor digitorum superficialis, FDPe – superficial epicondylar head of flexor digitorum profundus, FDPu – ulnar head of flexor digitorum profundus, FDPr – radial head of flexor digitorum profundus, m – median nerve, PQ – pronator quadratus, u – ulnar nerve]

Figure 3.2A-26. M. flexor carpi ulnaris, caudal view

[FCU – flexor carpi ulnaris, u – ulnar nerve]

M. MANUS GROUP – MEDIAN and ULNAR NERVES

mm. palmaris brevis, flexor digitorum breves manus^{m}, lumbricales, abductor digiti minimi^{u}, contrahentes^{u}, abductor pollicis brevis, flexor digitorum breves profundus^{u}

M. palmaris brevis may be represented in *Potamogale* by the muscle tissue on the deep surface of the large cartilaginous hypothenar eminence. Jullien (1967) did not describe m. palmaris brevis in *Potamogale*.

Mm. flexor digitorum breves manus is comprised of three fleshy bellies which originate from the cartilaginous tissue embedded in the ulnar side of the flexor retinaculum. The belly for digit V is a small leaf-shaped muscle with a central tendon. It inserts distal to the insertion of m. abductor digiti minimi on the lateral and medial sides of the metacarpophalangeal joint of digit V, thus forming a tunnel for the tendon of m. flexor digitorum profundus. The middle belly is longer and inserts on the lateral side of the metacarpophalangeal joint of digit IV. The radial belly is a 3 mm triangle with a 5 mm-long and thin tendon inserting on the lateral side of the metacarpophalangeal joint of digit II. Mm. flexor digitorum breves manus is innervated by the median nerve. My observations disagree with both Jullien (1967) and Verheyen (1961), who described only one m. flexor digitorum brevis manus which unites with m. flexor digitorum superficialis tendon for digit IV in *Potamogale* and *Micropotamogale*. It should be noted that Jullien (1967) made no mention of any tendons of m. flexor digitorum superficialis in *Potamogale*.

M. abductor digiti minimi originates from the pisiform and from cartilaginous tissue embedded in the ulnar side of the flexor retinaculum. The small fleshy belly sends a tiny clear tendon to the lateral side of metacarpal V.

There are four large and fleshy m. lumbricales originating from the surface of the conjoined tendon of m. flexor digitorum profundus in the palm. M. lumbricales for digits II-V insert on the medial side of the base of the proximal phalanges.

There are three mm. contrahentes. They originate from the ligaments of the carpals, superficial to mm. flexor digitorum breves profundus. Mm. contrahentes insert on the base of the proximal phalanges of digits I and II (lateral sides) and digit V (medial side). Tenrecs do not possess m. contrahens for digit IV (Jullien, 1967).

M. abductor pollicis brevis is absent in my specimen of *Potamogale*, although Jullien (1967) observed this muscle extending from the trapezium to digit I.

Mm. flexor digitorum breves profundus are ten in number, one pair for each metacarpal. The muscle on the radial side of digit I is the largest and appears to be the most superficial. It may be the muscle identified as m. abductor pollicis brevis in Jullien (1967). No opponens muscles are differentiated from mm. flexor digitorum breves profundus.

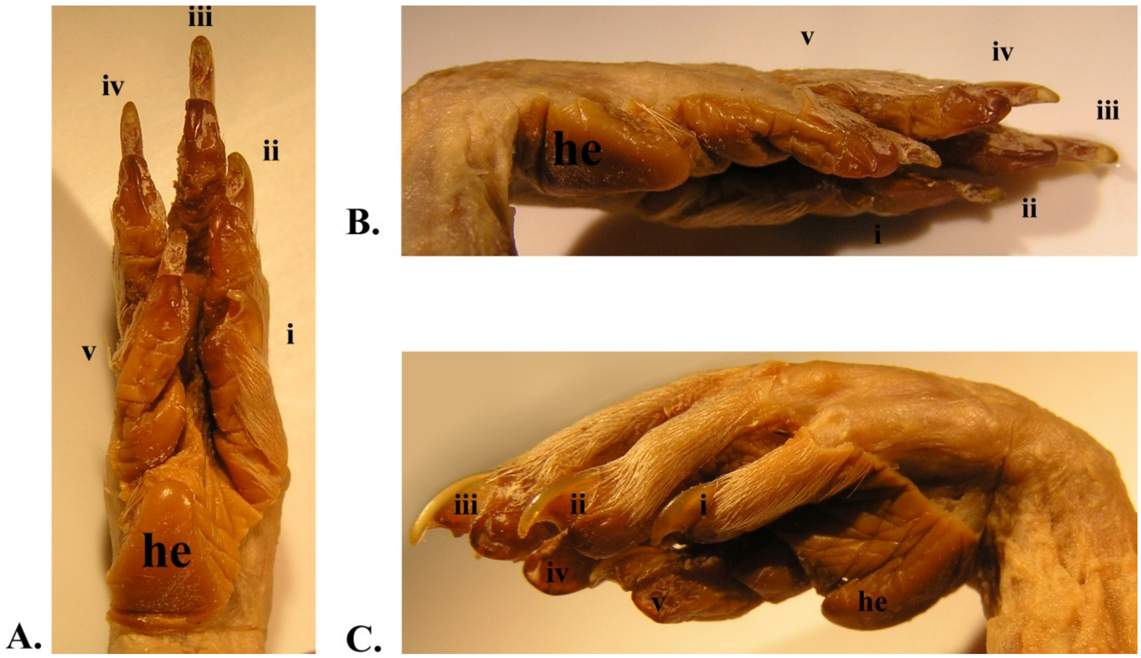


Figure 3.2A-27. Right manus, pre-dissection.

A. Palmar surface (P7233986). B. Lateral view (P7233992). C. Medial view (P7233994).

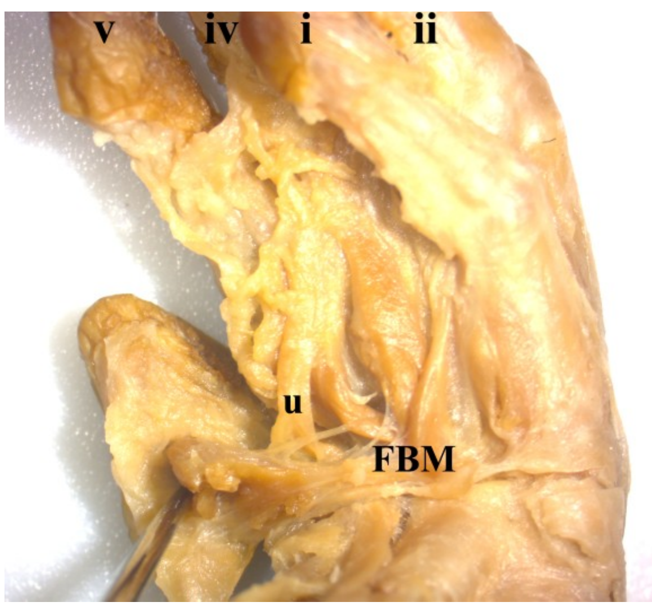
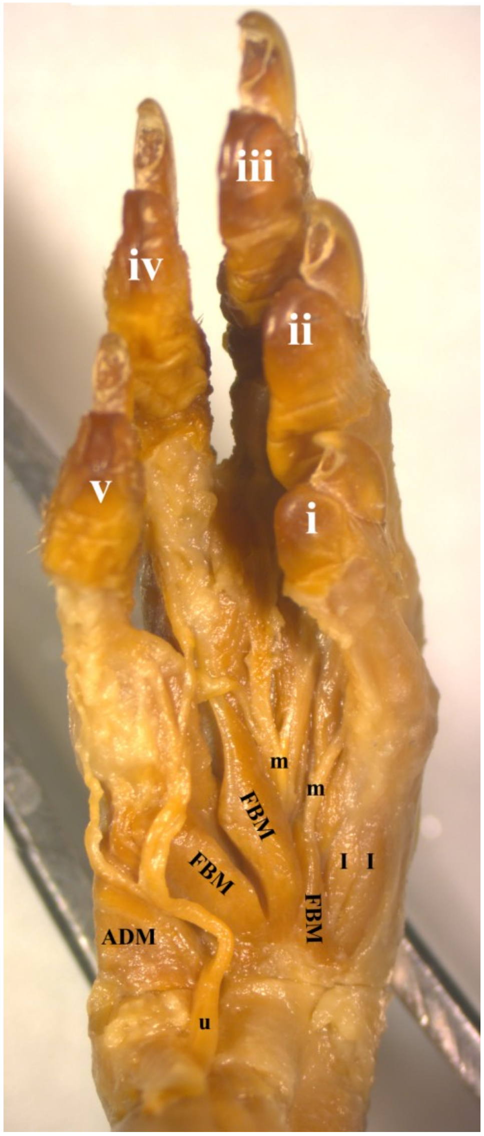


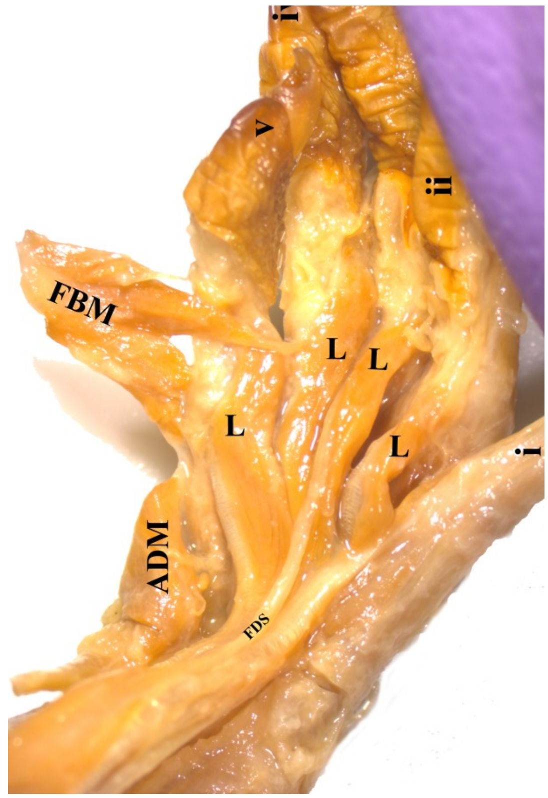
Figure 3.2A-28. M. palmaris brevis? at tip of probe (S-144604-0045).

[FBM – flexor digitorum breves manus, he – hypothenar eminence, u – ulnar nerve]

ADM – abductor digiti minimi, C – contrahentes, FBM – flexor digitorum breves manus, FDPe – superficial epicondylar head of flexor digitorum profundus, FDS – flexor digitorum superficialis, I – flexor digitorum breves profundus (“interossei”), L – lumbricales, m – median nerve, u – ulnar nerve



A.



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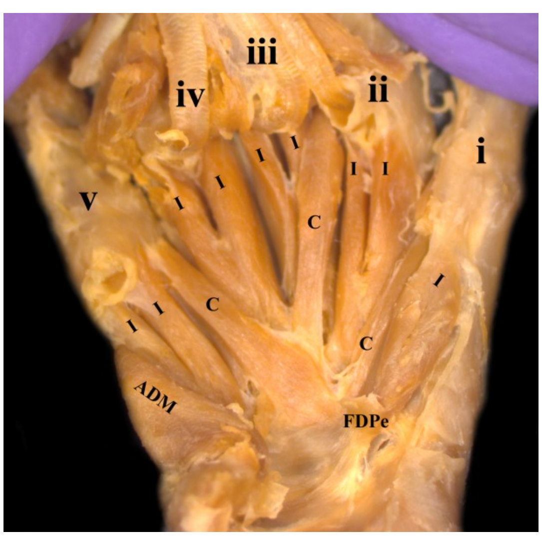


C.

Figure 3.2A-29. Muscles of the manus.

A. Superficial palm showing median and ulnar nerves and mm. flexor digitorum breves manus. B. Mm. lumbricales and flexor tendons. C. Mm. contrahentes and flexor digitorum breves profundus (S-125022-0045).

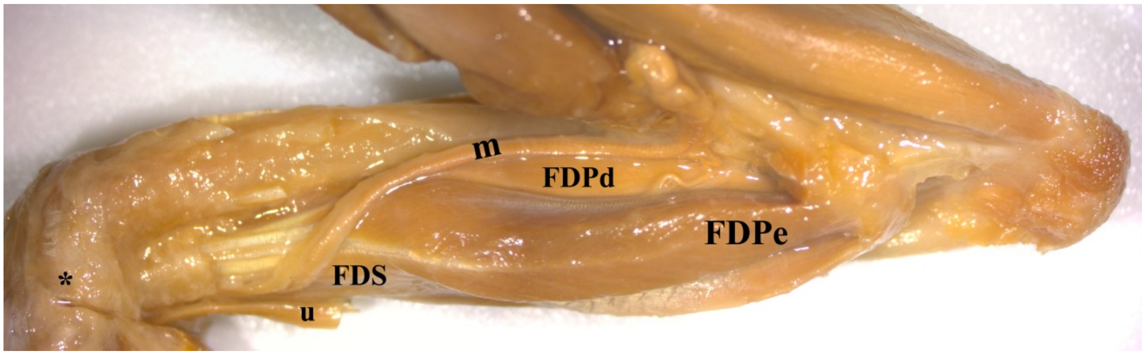


Figure 3.2A-30. Median nerve in forearm, medial view. Note flexor retinaculum.

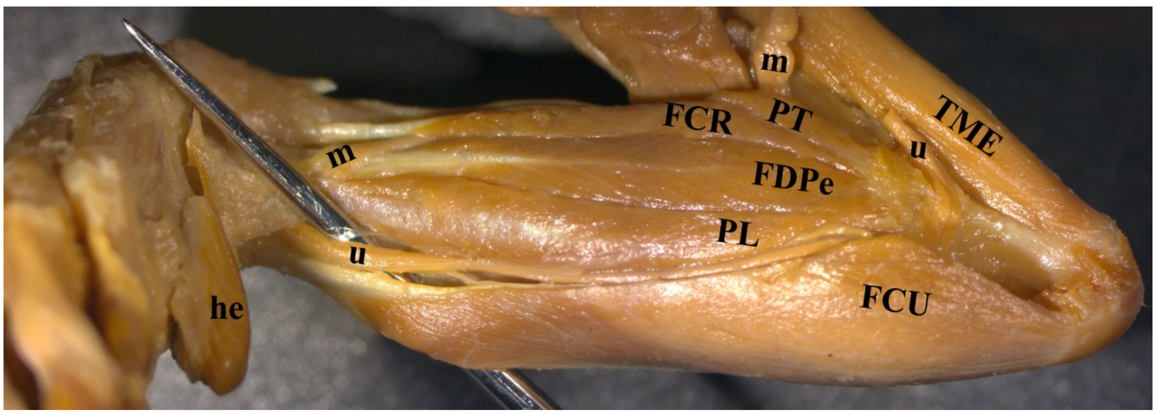
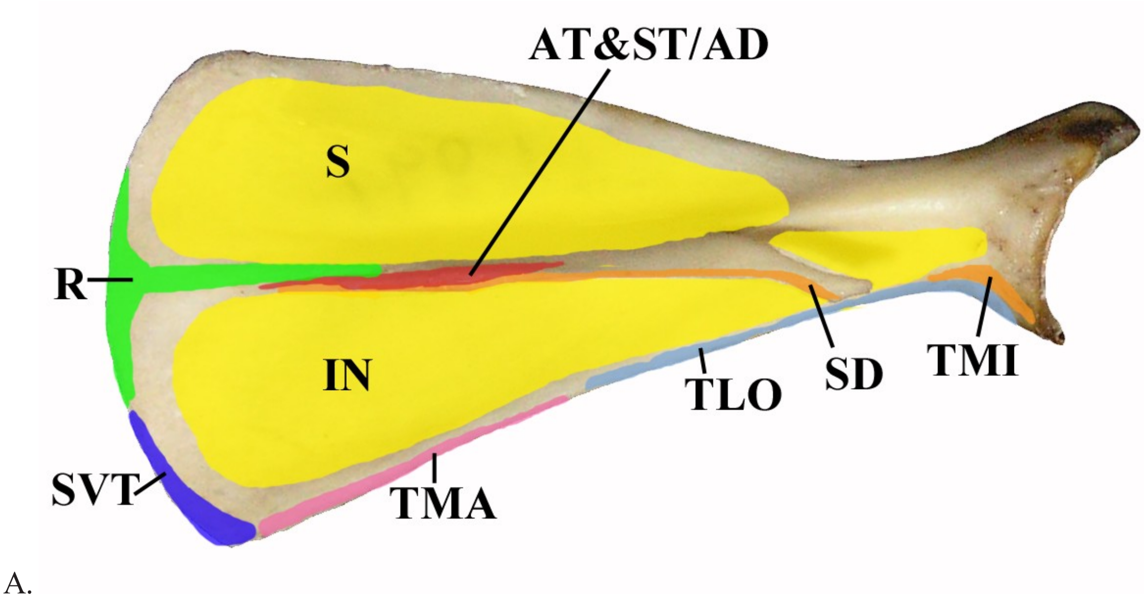
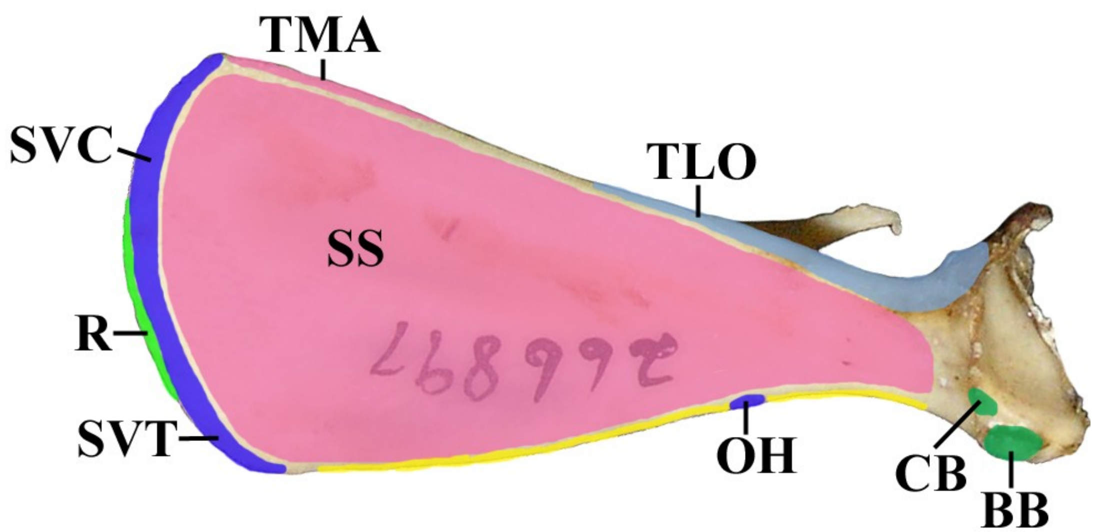


Figure 3.2A-31. Ulnar nerve in forearm, caudo-medial view.

[FDPd – deep epicondylar head of flexor digitorum profundus, FDPe – superficial epicondylar head of flexor digitorum profundus, FDS – flexor digitorum superficialis, FCR – flexor carpi radialis, FCU – flexor carpi ulnaris, he – hypothenar eminence, m – median nerve, PL – palmaris longus, PT – pronator teres, TME – triceps brachii caput mediale, u – ulnar nerve]



A.



B.

Figure 3.2A-32. Muscle attachment maps for the scapula.
A. Superficial surface of the scapula. B. Deep surface of the scapula.

[AT&ST/AD – acromiotrapezius et spinotrapezius / fused with acromiodeltoideus, BB – biceps brachii, CB – coracobrachialis, IN – infraspinatus, OH – omohyoideus, R – rhomboideus capitis et cervicis et thoracis, S – supraspinatus, SD – spinodeltoideus, SS – subscapularis, SVC – serratus ventralis cervicis, SVT – serratus ventralis thoracis, TLO – triceps brachii caput longum, TMA – teres major, TMI – teres minor]

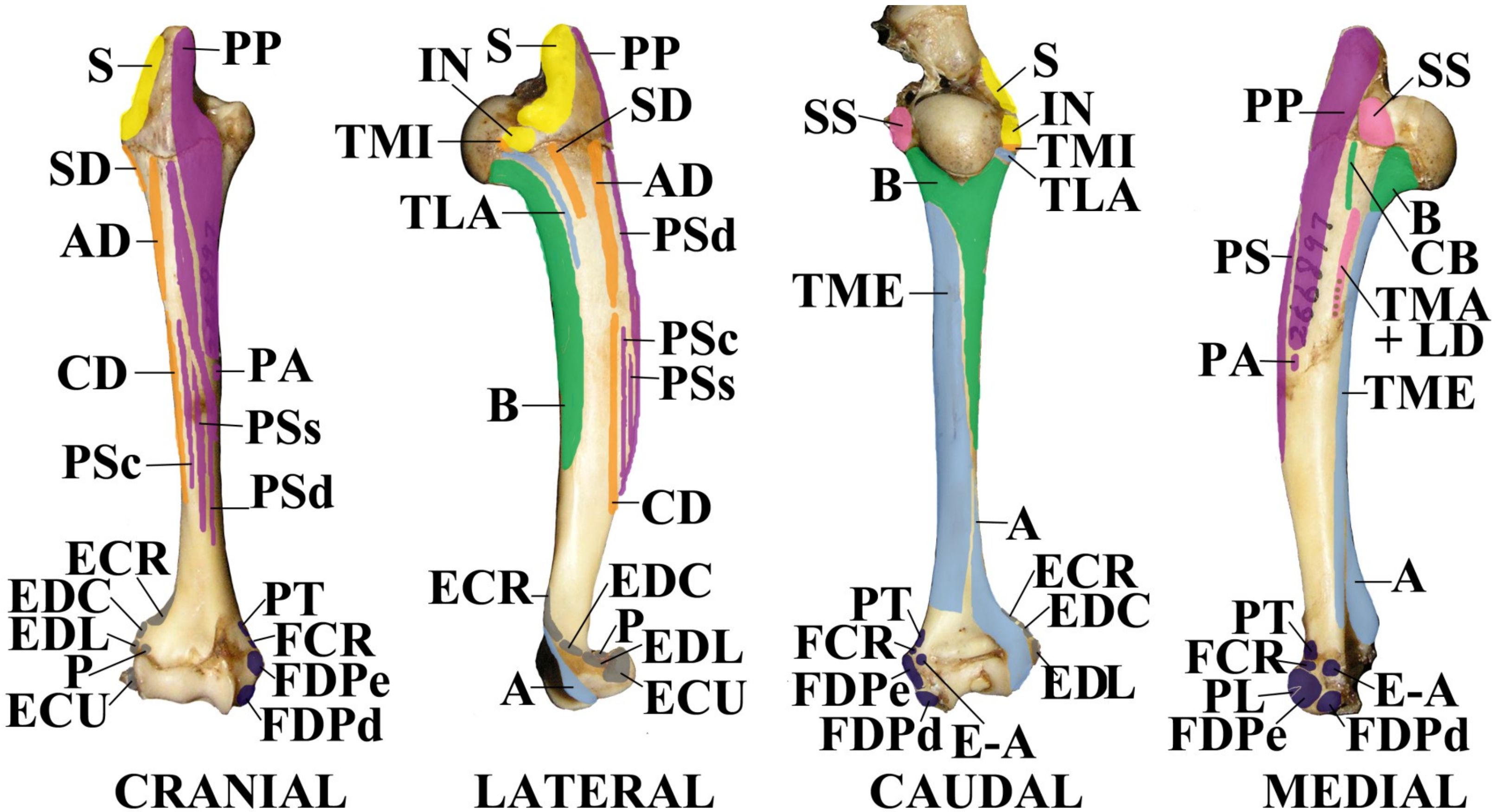


Figure 3.2A-33. Muscle attachment maps for the humerus.

[A- anconeus, AD- acromiodeltoideus, B- brachialis, CB- coracobrachialis, E-A- epitrochleo-anconeus, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, FDPe- superficial portion of flexor digitorum profundus, FDPd- deep portion of flexor digitorum profundus, IN- infraspinatus, LD- latissimus dorsi, PL- palmaris longus, PP- pectoralis profundus, PSc – clavicular portion of pectoralis superficialis, PSd- deep portion pectoralis superficialis, PSs- superficial portion of pectoralis superficialis, PT- pronator teres, S- supraspinatus, SD- spinodeltoideus, SS- subscapularis, TLA- triceps brachii caput laterale, TMA- teres major, TME- triceps brachii caput mediale, TMI- teres minor]

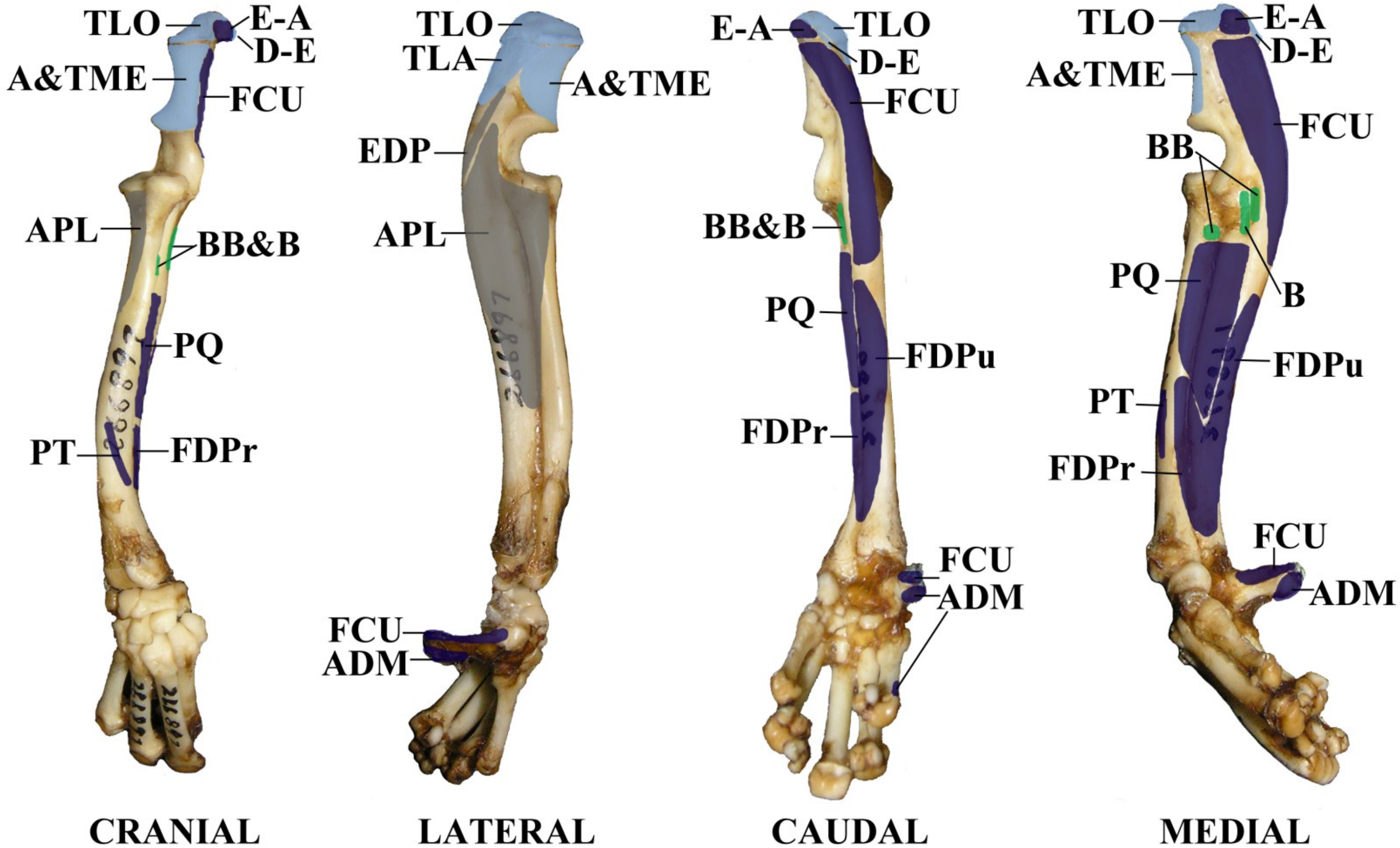


Figure 3.2A-34. Muscle attachment map for the radius and ulna.

[A – anconeus, ADM – abductor digiti minimi, APL – abductor pollicis longus, B – brachialis, BB – biceps brachii, D-E – dorso-epitrochlearis, E-A – epitrochlear-anconeus, EDP – extensor digitorum profundus, FCU – flexor carpi ulnaris, FDPr – radial head of flexor digitorum profundus, FDPu – ulnar head of flexor digitorum profundus, PT – pronator teres, PQ – pronator quadratus, TLA – triceps brachii caput laterale, TLO – triceps brachii caput longum TME – triceps brachii caput mediale]

3.2B – Afrosoricida – Tenrecidae – *Microgale dobsoni*

The forelimb myology of *Microgale dobsoni*, Dobson's shrew tenrec (Afrosoricida: Tenrecidae) has only briefly been discussed by Dobson (1882a, 1882b), and Dobson's account lacked full descriptions and illustrations. Other tenrecs with published descriptions of forelimb myology include *Tenrec*, *Setifer*, *Potamogale*, and *Micropotamogale* (Dobson, 1882b, 1883; Verheyen, 1961; Jullien, 1967; Neveu & Gasc, 2002). Here I describe the extrinsic and intrinsic muscles of the forelimb of a female specimen of *Microgale dobsoni* collected for the American Museum of Natural History in Madagascar in 1929. The specimen is ill-preserved and a shot has entered the thorax and blown out the dorsum of the specimen between the scapulae. This damage prevented the full description of all the muscles attaching onto the scapula. Although fragile, the intrinsic muscles of the forelimb were in much better condition. Due to the very small size of the animal, dissections were performed under a microscope.

0. CUTANEOUS MUSCULATURE and MAMMARY GLAND

mm. panniculus carnosus

The cutaneous musculature covering the dorsum of the animal and the lateral and ventral thorax was poorly preserved and I was generally unable to determine any muscle fiber direction. However, I was able to determine one point of insertion of <u>m. panniculus carnosus</u>. There is a thin cylinder of muscle that inserted near the lesser tuberosity of the humerus deep and just proximal to the insertion of pectoralis abdominalis.

The axillary mammary gland extends from the ventral thorax, over the lateral elbow, and along the caudal arm covering the triceps. It may even reach the back between the scapulae, but this part of the specimen is quite damaged.

Figure 3.2B-1. Pre-dissection photograph of *Microgale dobsoni*, AMNH 100850

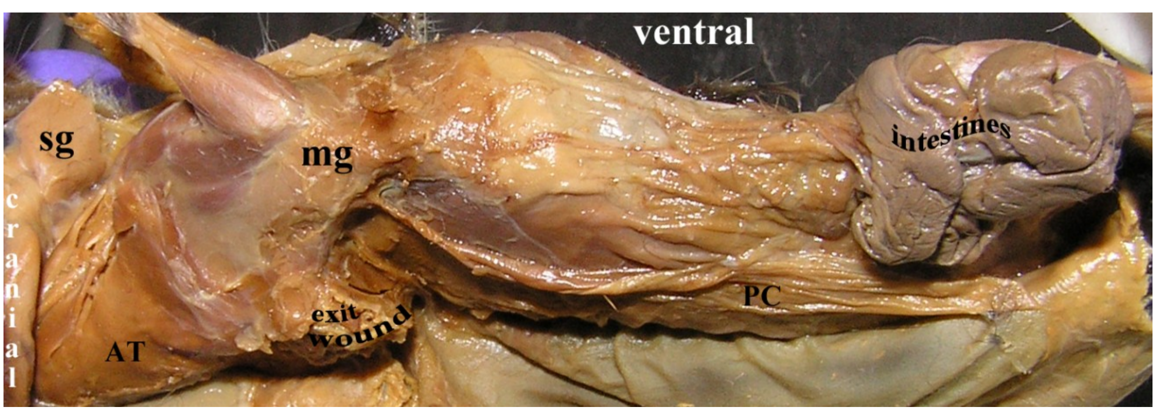


Figure 3.2B-2. M. panniculus carnosus and axillary mammary gland, lateral view (P2142528)

A. TRAPEZIUS GROUP – ACCESSORY NERVE and CERVICAL NERVES

mm. sternomastoideus, cleidomastoideus, clavotrapezius, acromiotrapezius, spinotrapezius

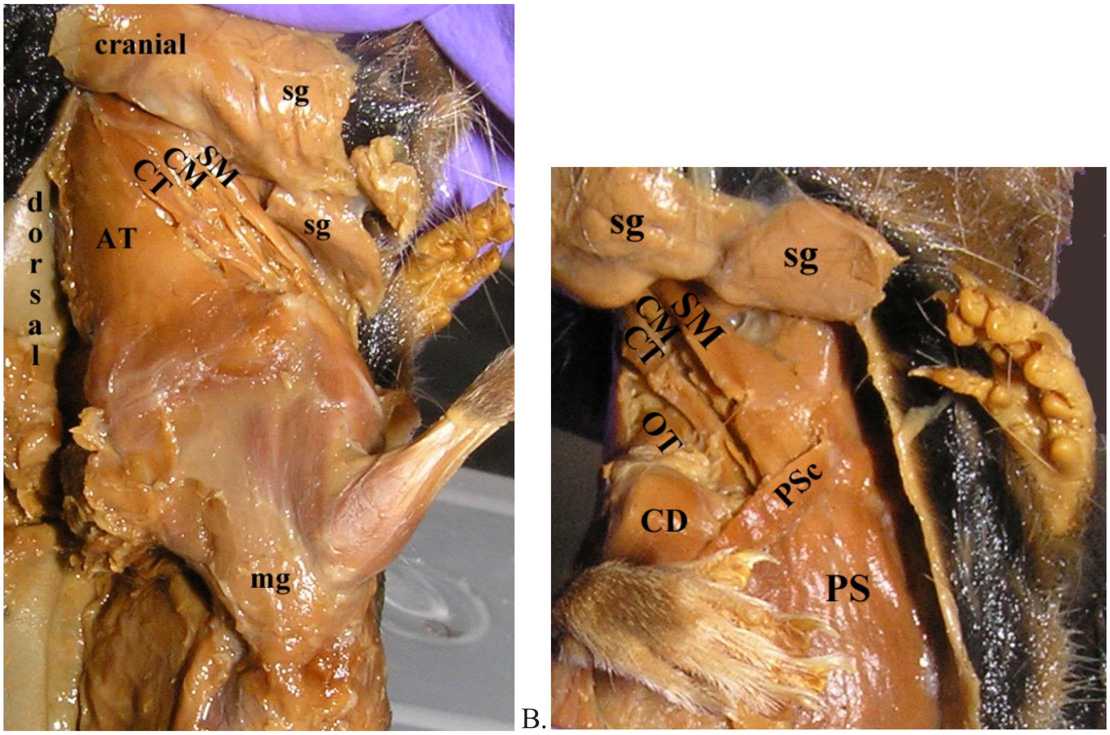
M. sternomastoideus originates from the mastoid process and inserts on the surface of the manubrium and sternum. At insertion the muscle expands to 3 mm wide. Dobson (1882a) reported that the slender tendon of m. sternomastoideus unites with the edge of m. cleidomastoideus at the mastoid process, but in this specimen of *Microgale* m. cleidomastoideus did not attach there.

M. cleidomastoideus is weakly attached to the occiput lateral to m. clavotrapezius and dorsal to m. sternomastoideus. It is only 1.5 mm wide and the few fibers making up the muscle were easily broken. It inserts on the manubrium, under cover of the lateral edge of m. sternomastoideus muscle.

M. clavotrapezius originates from the occipital crest inferolateral to the origin of m. acromiotrapezius. It is 1.5 mm wide and crosses superficial to m. omotransversarius to insert on the cranial surface of the lateral third of the clavicle. It is separated from m. acromiotrapezius by the great auricular nerve.

M. acromiotrapezius originates from the medial occipital crest and from the cervical and proximal thoracic vertebrae. It inserts on the acromion and nearly the full length of the scapular spine.

The origin of m. spinotrapezius was damaged by the bullet. It inserts on the caudal edge of the posterior end of the scapular spine, in connection with the insertion of m. acromiotrapezius.



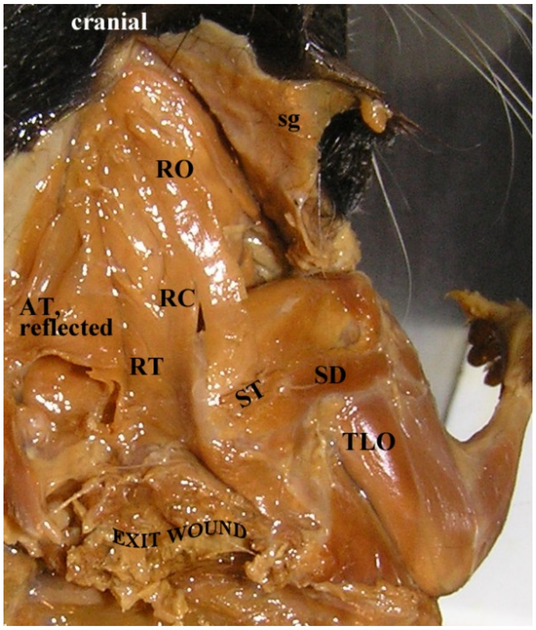
A. B.

Figure 3.2B-3. Trapezius complex
A. Lateral view (P2142505). B. Ventral view (P2142526).

B. RHOMBOID GROUP – DORSAL SCAPULAR NERVE

mm. rhomboideus capitis, rhomboideus cervicis et thoracis

M. rhomboideus capitis originates from the occiput immediately deep to the origin of m. acromiotrapezius. It inserts on the cranial edge of the base of the scapular spine. The middle of m. rhomboideus capitis is briefly fused with the cranial end of m. rhomboideus cervicis et thoracis, which originates for 9 mm from the cervical and thoracic vertebrae. It inserts along the entire vertebral border of the scapula.

A. 

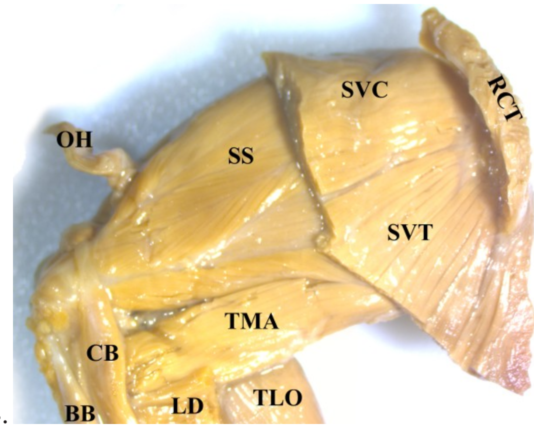
B. 

Figure 3.2B-4. Mm. rhomboideus
A. Dorsal view, showing origins (P3092740). B. M. rhomboideus cervicis et thoracis inserting on the deep surface of the scapula.

C. OMO GROUP – CERVICAL NERVES, LONG THORACIC NERVE

mm. omotransversarius, omohyoideus, serratus ventralis (cervicis, thoracis)

The tiny m. omotransversarius originates from the atlas. When it emerges from deep to m. clavotrapezius, it gradually widens to 3 mm and inserts superficial to m. acromiotrapezius on the acromion.

The bony origin of m. omohyoideus was unable to be determined, but it originates as two ribbons which fuse to a single flat ribbon only 1.5 mm wide. It travels between the cranial edges of mm. supraspinatus and subscapularis to insert via fleshy fibers onto a slight rugosity on the cranial surface of the neck of the scapula.

M. serratus ventralis cervicis originates from cervical vertebrae 2-7 and is 7 mm wide. It inserts on the ventral surface of the cranial half of the vertebral border of the scapula. The origin and general structure of m. serratus ventralis thoracis was damaged by the bullet wound. It appears to have been ~6 mm wide with at least three digitations from the ribs. It has a small insertion on the dorsal surface of the caudal angle of the scapula, but most of the muscle inserts on the ventral surface of the caudal half of the vertebral border of the scapula. The division into cervical and thoracic parts is visible at insertion, but the two parts insert together.

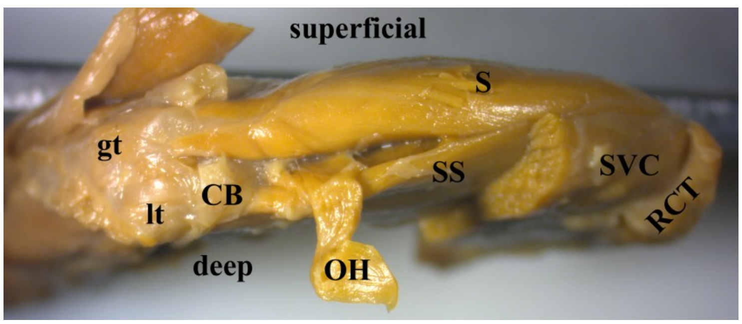


Figure 3.2B-5. M. omohyoideus inserting on cranial border of scapula. (S-135027-0048)

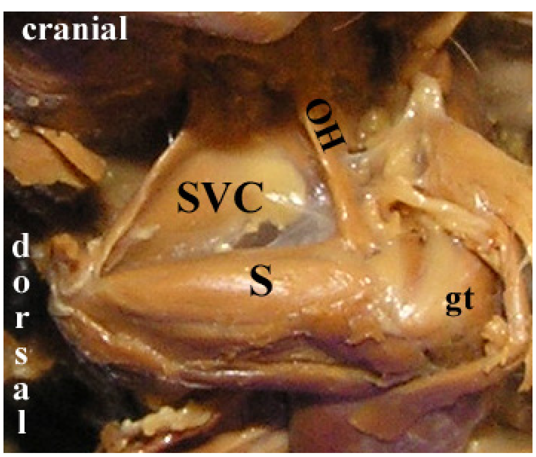
A.


Figure 3.2B-6. Mm. serratus ventralis cervicis and omohyoideus, cranio-lateral view (P3192876)

D. DELTOID GROUP – AXILLARY NERVE

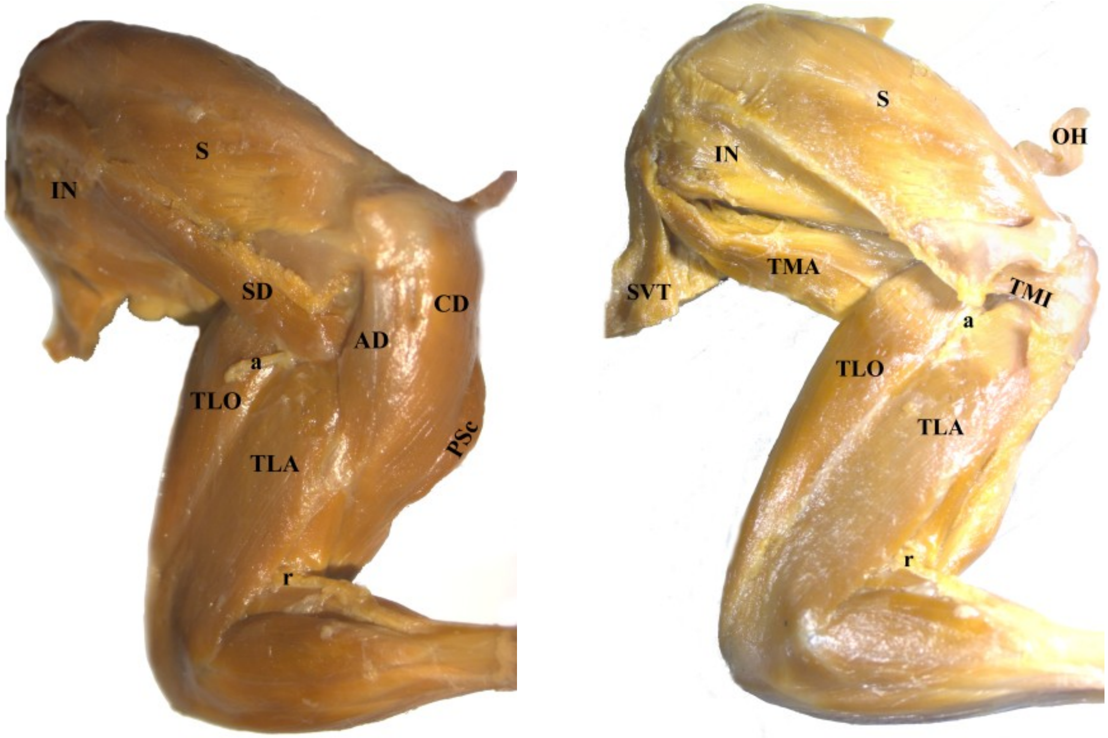
mm. clavodeltoideus, acromiodeltoideus, spinodeltoideus, teres minor

M. clavodeltoideus originates for 4 mm from the lateral half of the caudal edge of the clavicle. It fuses with m. acromiodeltoideus and inserts lateral to the clavicular portion of m. pectoralis superficialis on the craniolateral surface of the humerus.

M. acromiodeltoideus is a 1.5 mm-wide muscle originating from the acromion process. It fuses with m. clavodeltoideus and inserts for 5mm on the delto-pectoral crest on the cranio-lateral surface of the humerus.

M. spinodeltoideus is fairly thick but only 2 mm wide. It originates from the caudal surface of the spine of the scapula and spreads over the fascia of m. infraspinatus. It inserts lateral to m. acromiodeltoideus on the delto-pectoral crest of the humerus, in connection with the tendinous fascia of the origin of m. triceps brachii caput laterale.

M. teres minor originates from the deep surface of the acromion process and inserts on the distal end of the greater tuberosity of the humerus. The small m. teres minor is divisible from m. infraspinatus only by a small ligament extending from the metacromion to the neck of the scapula and passing between the two muscles.



A. B.

Figure 3.2B-7. Mm. deltoideus and teres minor

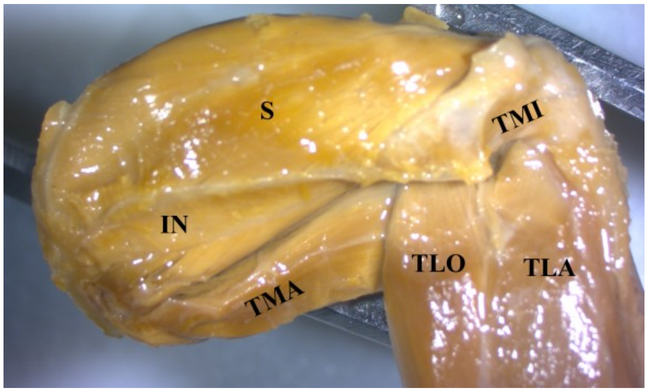
A. Superficial lateral. B. Deep lateral.

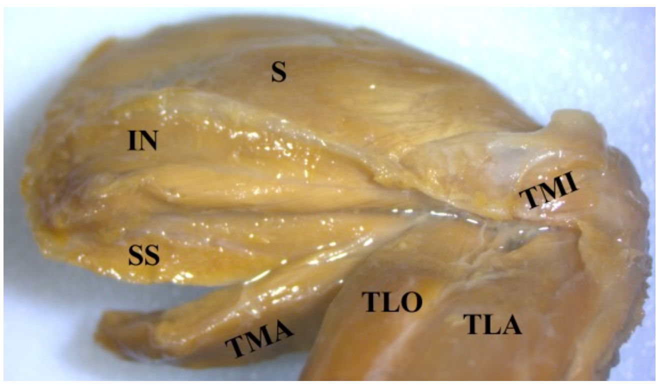
E. SUBSCAPULARIS GROUP – SUBSCAPULAR NERVE

mm. subscapularis, teres major

M. subscapularis originates from the subscapular fossa, except along the vertebral border where mm. rhomboideus and serratus ventralis insert. The muscle consists of two pinnate bundles that converge to a strong tendon which inserts on the caudal surface of the lesser tuberosity of the humerus, deep to the tendon of origin of m. coracobrachialis.

M. teres major is a thick, 2 mm-wide muscle. It originates mostly off the caudal edge of m. subscapularis, but also from the lateral half of the caudal border of the scapula. It inserts deep to m. coracobrachialis and proximal to the insertion of m. latissimus dorsi on the cranio-medial surface of the humerus.

A. 

B. 

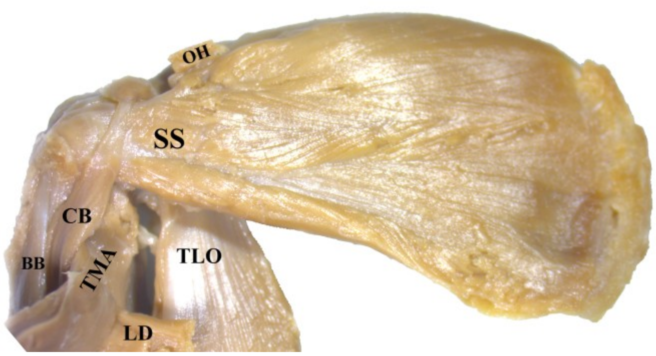
C. 

Figure 3.2B-8. Mm. subscapularis and teres major

A. Superficial surface of scapula with m. teres major intact (S-162309-0049). B. Superficial surface of scapula with m. teres major reflected (S-162529-0050). C. Deep surface of scapula with m. teres major reflected. (S-163546-0058)

F. LATISSIMUS GROUP – THORACODORSAL NERVE

m. latissimus dorsi

The origin of m. latissimus dorsi was damaged by the bullet wound. It inserts on the cranio-medial surface of the humerus just distal to m. teres major, remaining distinct from it.

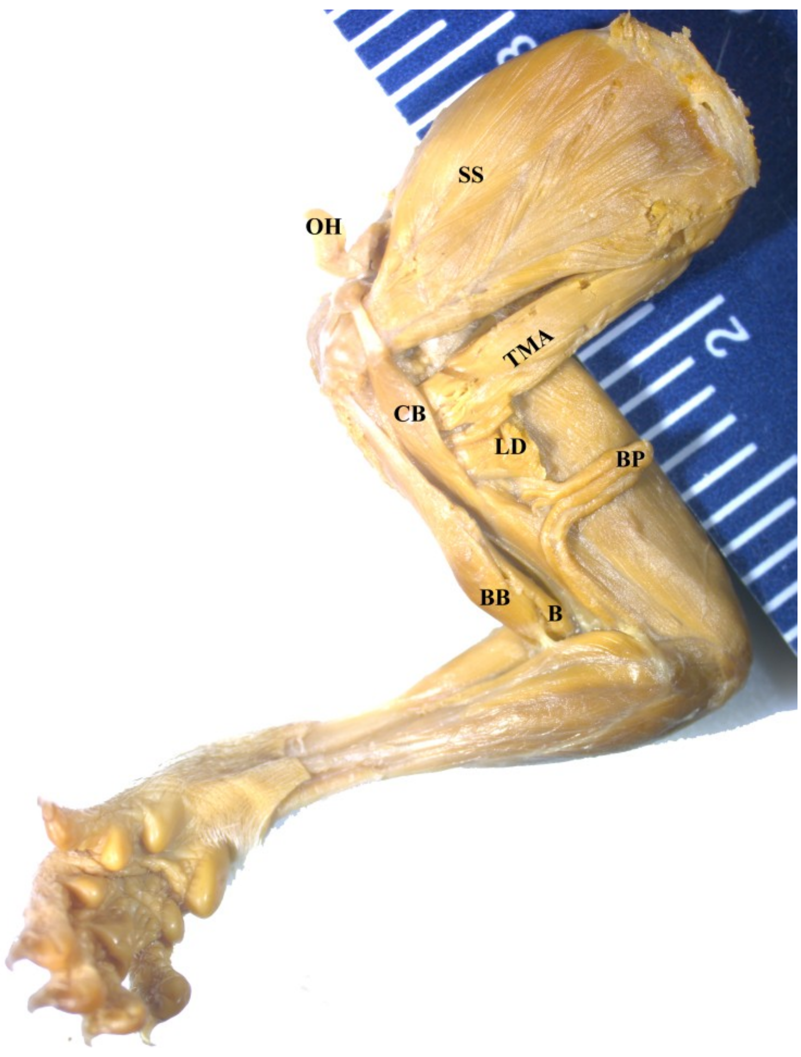


Figure 3.2B-9. Mm. latissimus dorsi and teres major inserting deep to m. coracobrachialis, medial aspect of forelimb

G. PECTORALS GROUP – PECTORAL NERVES

mm. pectoralis superficialis (clavicular, superficial, deep), pectoralis profundus, pectoralis abdominalis, subclavius, sternoscapularis

The clavicular portion of m. pectoralis superficialis originates from the manubrium and crosses the thorax to insert on the cranial surface of the humerus, medial to mm. deltoideus and lateral to mm. pectoralis superficialis. I was unable to determine innervation, but in *Potamogale* this muscle receives pectoral nerves.

Mm. pectoralis superficialis is a broad triangular sheet of muscle which originates proximally from the manubrium deep to the insertion of m. sternomastoideus; distally the origin is destroyed by the shot wound. The muscle sheet is partially split into two layers, making the insertion bifid. The superficial layer of m. pectoralis superficialis is 4 mm wide and the fibers angle more caudally. It fuses with the deep layer of m. pectoralis superficialis proximally, but its distal medial edge is free. The deep layer of m. pectoralis superficialis is 5 mm wide and inserts in a curving line on the cranial surface of the humerus distally to midshaft, medial to the insertion of mm. deltoideus.

M. pectoralis profundus originates from the ribs, just inferolateral to the shot wound. It travels deep to m. pectoralis superficialis and is only partially visible near its origin. It inserts on the cranial aspect of the proximal humerus, spanning the tendon of m. biceps brachii which glides between the greater and lesser tuberosities.

M. pectoralis abdominalis originates from the lateral thorax and inserts down the cranial surface of the humerus for 5 mm, superficial to the belly of m. biceps brachii.

M. subclavius is absent. Dobson (1882a, 1882b) described m. subclavius from the sternum and rib 1 to the lateral clavicle, but I did not observe this. However, Dobson

(1882a, 1882b) did not note m. sternoscapularis, which was damaged by the shot wound. In the axilla, m. sternoscapularis is 2 mm wide and inserts on the cranial edge of the greater tuberosity, and fuses with fascia under the clavicle.

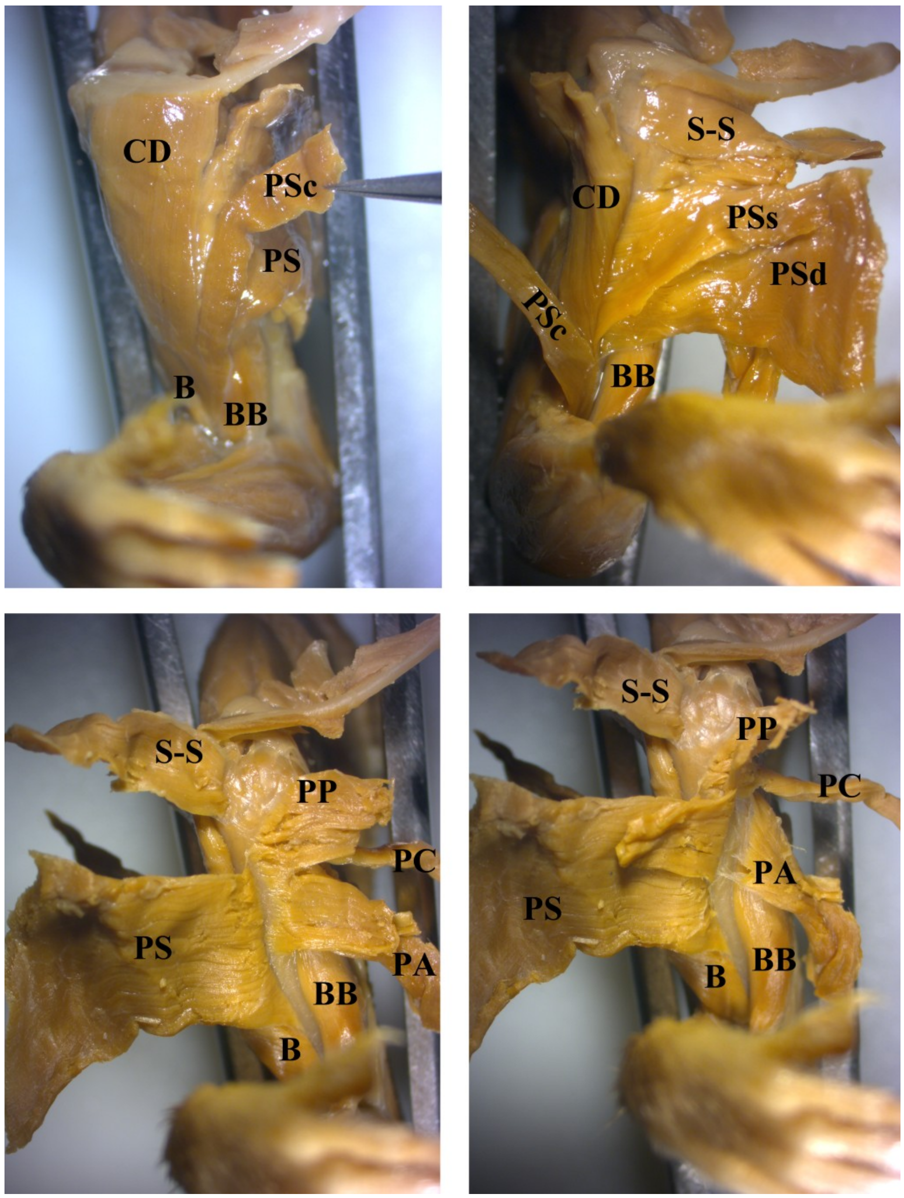


Figure 3.2B-10. Mm. deltoideus and pectoralis inserting on the humerus

[B – brachialis, BB – biceps brachii, CD – clavodeltoideus, PA – pectoralis abdominalis, PC – panniculus carnosus, PS – pectoralis superficialis (PSc – clavicular portion, PSd – deep portion, PSs – superficial portion), PP – pectoralis profundus, S-S- sternoscapularis]

H. BICEPS GROUP – MUSCULOCUTANEOUS NERVE

mm. coracobrachialis, biceps brachii, brachialis, cubitalis

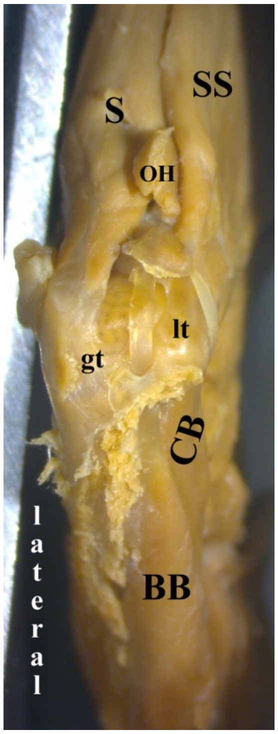
M. coracobrachialis is a 7 mm-long belly that originates off the coracoid process. Its tendon of origin crosses over the tendon of insertion of m. subscapularis. The triangular muscle inserts on the cranio-medial surface of the humerus at about midshaft, superficial to the insertions of mm. teres major and latissimus dorsi.

M. biceps brachii consists of a single belly; superficially a slight division demarcates the short and long heads, but they are well fused below the surface. The muscle originates via a tendon from the supraglenoid tubercle of the scapula. The tendon travels deep to the transverse humeral ligament spanning between the greater and lesser tuberosities. The muscle belly lies on the cranial surface of the arm lateral to m. coracobrachialis and medial to the insertion of mm. pectoralis. M. biceps brachii twists around the tendon of insertion of m. biceps brachii and inserts on the caudo-medial surface of the radial neck.

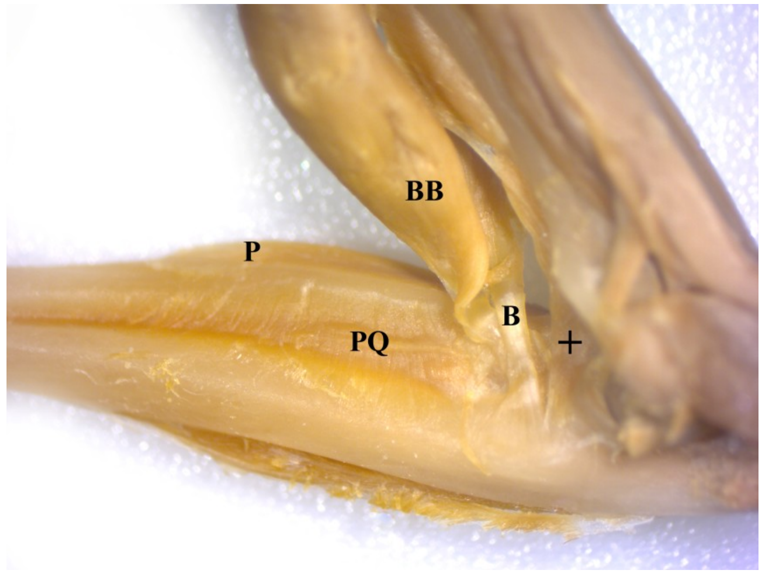
M. brachialis originates from the caudal neck of the humerus, just below the head of the humerus, and from the proximal half of the caudo-medial humeral shaft. It sweeps craniolaterally around the humerus, and inserts on the medial ulna.

The musculocutaneous nerve emerges lateral to m. coracobrachialis. It sends a branch to m. biceps brachii, then travels along the cranial humerus before passing lateral to m. brachialis to reach the forearm integument.

There is an additional very small muscle, here named m. cubitalis, originating deep to the other muscles along the cranial surface of the humerus, and inserting on the ulna with m. brachialis. This muscle is also seen in *Calcochloris* and in paenungulates.



A.



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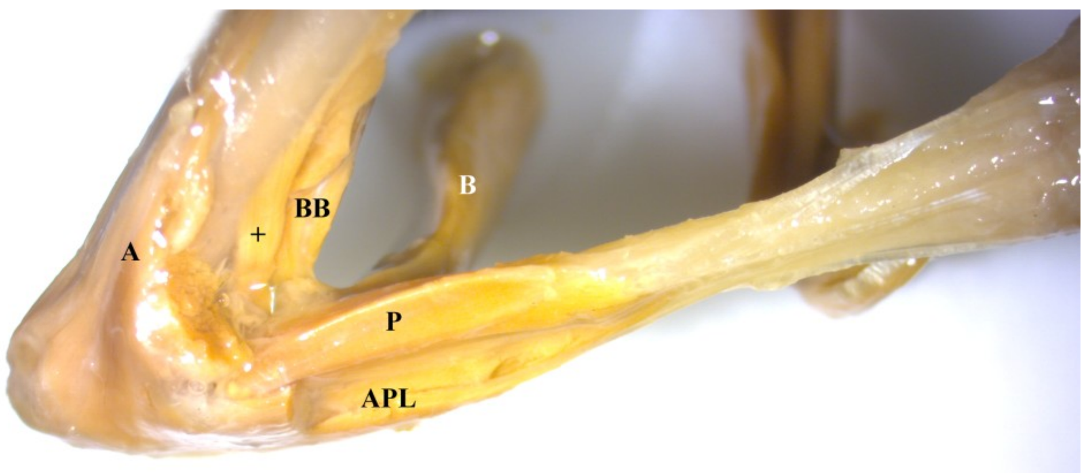


C.

Figure 3.2B-11. Muscles of the biceps group

A. Origin of m. biceps brachii, cranial view (S-161039-0043). B. Insertions of muscles of the biceps group, medial view (S-143913-0030). C. M. cubitalis, lateral view (S-144939-0031)

I. SPINATI GROUP – SUPRASCAPULAR NERVE

mm. supraspinatus, infraspinatus

M. supraspinatus is a robust muscle which originates from the entire supraspinous fossa, the cranial edge of the scapular spine, and the cranial border of the scapula. Its strong tendon inserts into the top of the greater tuberosity of the humerus.

M. infraspinatus is much smaller than m. supraspinatus. It originates from the infraspinous fossa and the caudal surface of the spine of the scapula, also filling the space beneath the acromion. It inserts deep to the acromioclavicular joint on the caudo-lateral surface of the greater tuberosity of the humerus.

Figure 3.2B-12. Mm. supraspinatus, infraspinatus, and brachialis. Lateral view

J. TRICEPS GROUP – RADIAL NERVE

mm. dorso-epitrochlearis, triceps brachii (caput laterale, caput mediale, caput longum), anconeus

M. dorso-epitrochlearis was very slight and its origin was damaged during the dissection, but it seems to have taken origin from m. latissimus dorsi. It inserts for 2 mm along the medial side of the olecranon.

The triceps brachii muscle is large, and as in Tubulidentata and Macroscelidea, it has four heads of origin due to the two heads of m. triceps brachii caput longum.

M. triceps brachii caput longum superficialis originates via fleshy fibers for 3 mm along a rugosity on the caudal neck of the scapula. M. triceps brachii caput longum profundus originates as a 2 mm-wide tendon from the caudo-ventral surface of the neck of the scapula. The two parts of m. triceps brachii caput longum fuse 8 mm from the origin, and then on their lateral edge with m. triceps brachii caput laterale, and insert together on the caudal surface of the olecranon. The deep surface of their tendon has a cartilaginous thickening which slides over the tip of the olecranon.

M. triceps brachii caput laterale originates for 4 mm along the proximal lateral humerus, lateral to the insertion of mm. deltoideus and medial to the origin of m. brachialis. It inserts on the lateral surface of the olecranon via tendinous fibers, slightly fused on its caudal edge with m. triceps brachii caput longum.

M. triceps brachii caput mediale originates from the distal half of the caudal and medial surfaces of the humerus. It inserts on the cranial surface of the olecranon, deep to mm. triceps brachii caput longum.

M. anconeus is a robust triangular muscle originating from the back of the lateral epicondyle and supracondylar crest. It inserts on the lateral olecranon deep to the insertion of m. triceps brachii caput laterale and onto the surface of m. extensor digitorum profundus in the forearm.

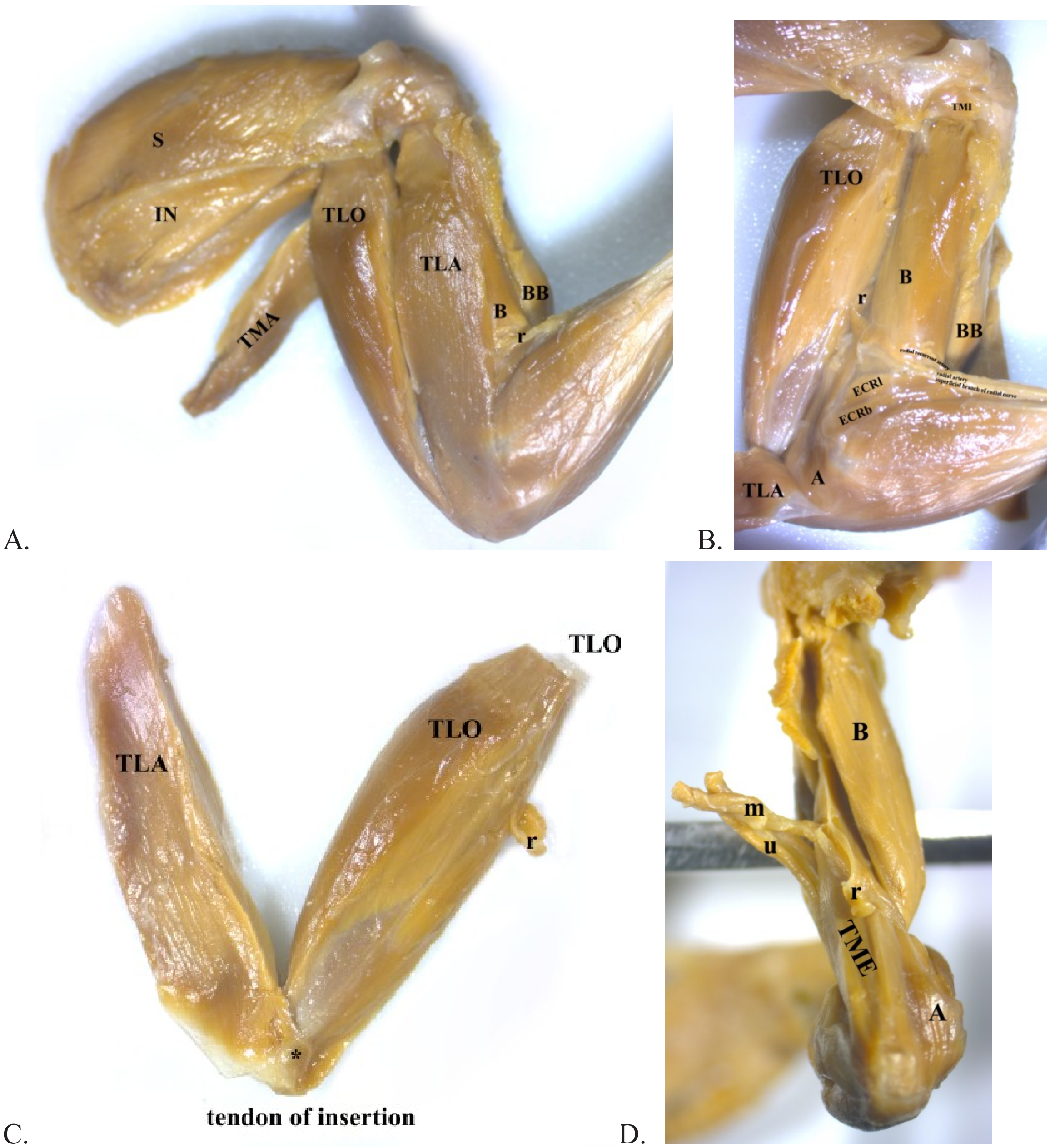
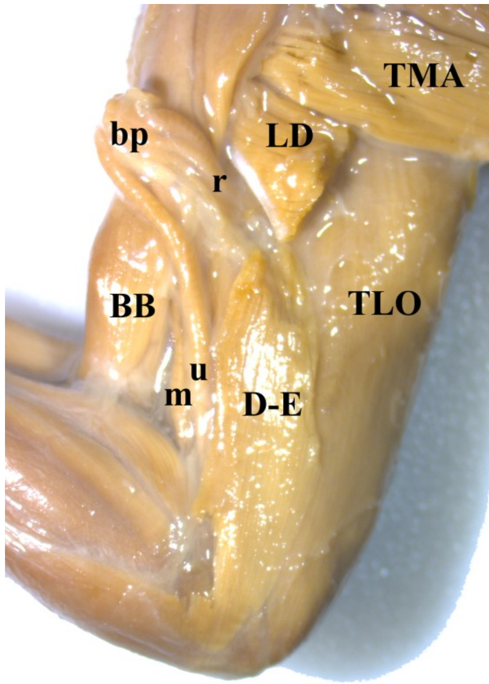


Figure 3.2B-13. Mm. triceps brachii
A. Lateral view. B. Deep lateral view. C. Deep surface of mm. triceps brachii caput longum et laterale tendon. D. Caudal view.



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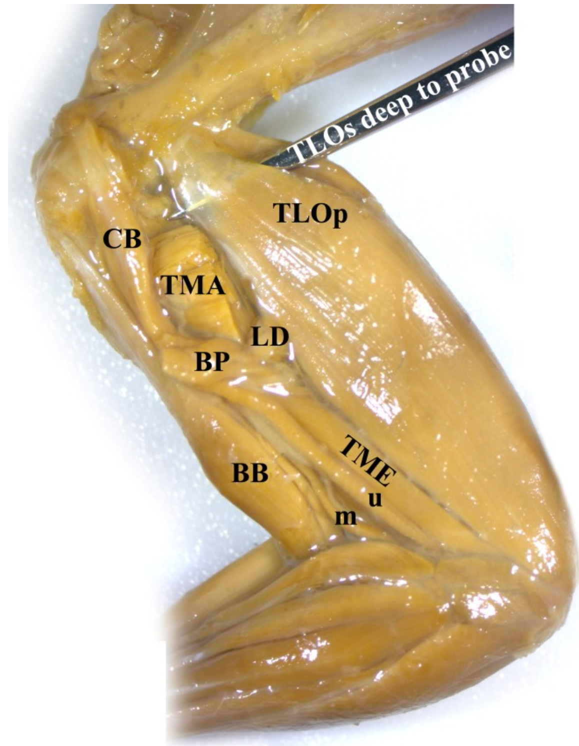

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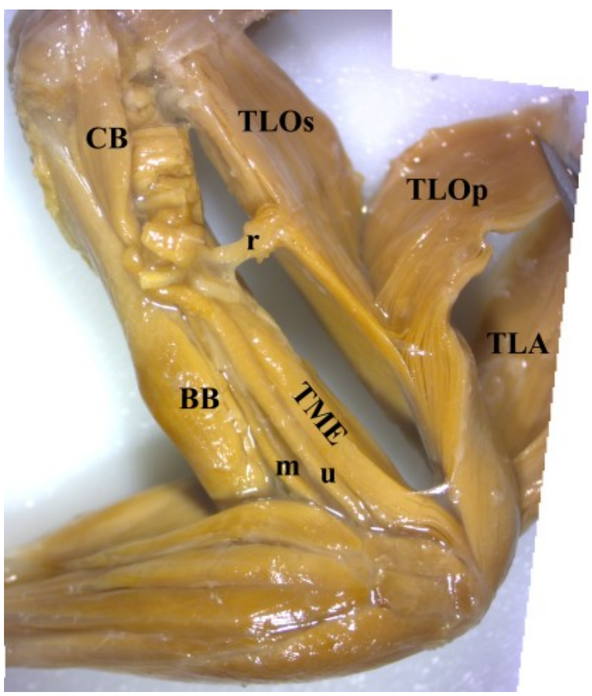


G.

Figure 3.2B-13 continued. Mm. triceps brachii. E. M. dorso-epitrochlearis. F. Medial view. G. Deep medial view.

K. EXTENSOR GROUP – RADIAL NERVE

mm. brachioradialis, extensor carpi radialis longus et brevis, extensor digitorum communis, extensor digitorum lateralis, extensor carpi ulnaris, supinator, abductor pollicis longus, extensor digitorum profundus

M. brachioradialis is absent.

M. extensor carpi radialis is made up of two bellies which originate independently from the supracondylar ridge. The cranial or superficial belly, m. extensor carpi radialis longus, has the most cranial origin off the lateral epicondyle of the humerus. The belly is 6 mm long; it becomes tendinous at about radial midshaft and inserts on the base of the dorsal surface of metacarpal II. M. extensor carpi radialis brevis originates just inferior to m. extensor carpi radialis longus. It also becomes tendinous at radial midshaft, and it travels just lateral to the tendon of m. extensor carpi radialis brevis to insert on the base of the dorsal surface of metacarpal III. The tendons of insertion of both portions remain deep to the tendons of insertion of m. extensor digitorum profundus.

M. extensor digitorum communis is made up of three tiny muscle bellies which originate from the larger m. extensor digitorum lateralis. The bellies extend for 6 mm and then become extremely slender tendons which travel in the groove at the distal radius and under the extensor retinaculum. In the dorsum of the manus, they expand and insert on the medial side of digits II-IV.

M. extensor digitorum lateralis is the largest of the muscle bellies originating from the lateral epicondyle. Its fleshy belly extends for 8 mm then divides into three tendons; the medial two insert on the lateral side of digits III and IV and the larger lateral tendon inserts along the center of digit V.

M. extensor carpi ulnaris originates from the lateral epicondyle. The belly is fleshy for 9 mm and then becomes a tendon which expands greatly over the carpals and inserts on the base of metacarpal V.

M. supinator originates deep to the extensors from the cranial surface of the lateral epicondyle, and also from the surface of m. abductor pollicis longus. It is only 7 mm long, and inserts on the cranial surface of the proximal third of the radius.

M. abductor pollicis longus is a pinnate muscle with two heads of origin, one from the lateral epicondyle deeper than the other extensors and the other from the lateral ulna. They quickly join and form a 7 mm-long fleshy belly with a large central tendon. The muscle becomes entirely a broad, flat tendon, which crosses the cranial radius deep to m. extensor digitorum tendons and superficial to m. extensor carpi radialis. It inserts on the medial side of the base of metacarpal I.

M. extensor digitorum profundus originates from the lateral surface of the proximal ulna, then crosses deep to mm. extensor digitorum communis, extensor digitorum lateralis, and extensor carpi ulnaris to send a single tendon over the carpus. The tendon splits into two over the metacarpals, and inserts on the medial side of digits I and II.

The radial nerve curves around the caudal side of the humerus at about midshaft. Laterally, it emerges as the superficial radial nerve from between mm. brachialis and triceps brachii caput laterale, and travels superficial to m. extensor carpi radialis to provide sensory innervation to the medial side of the dorsal surface of the manus.

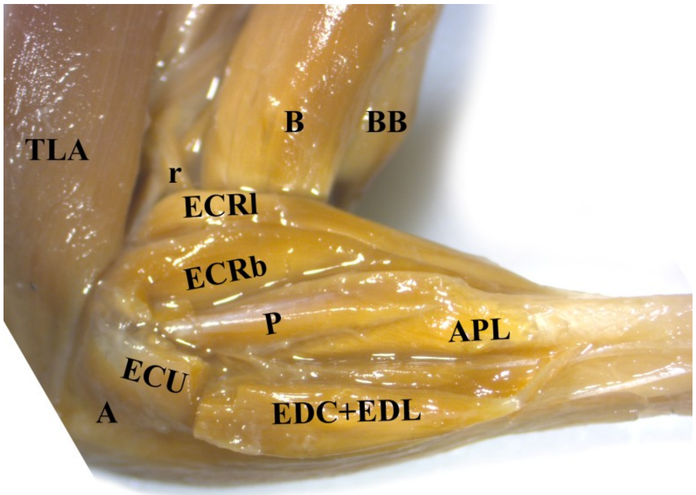


Figure 3.2B-14. Mm. extensor carpi radialis longus et brevis, lateral view (S-152450-0030)

Figure 3.2B-15. M. extensor digitorum profundus, lateral view

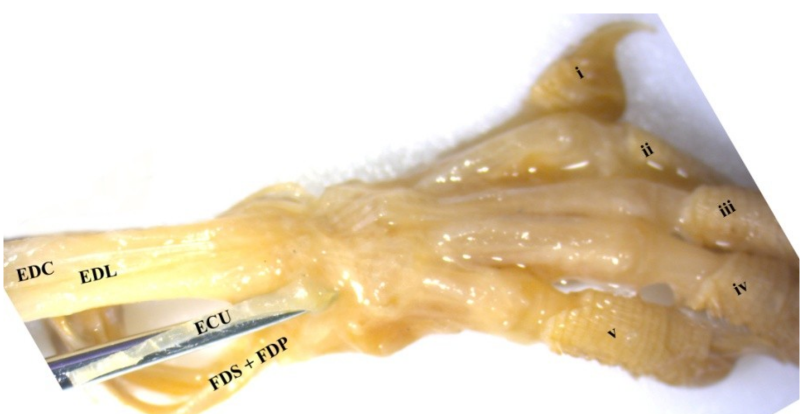


Figure 3.2B-16. M. extensor M. extensor carpi ulnaris insertion, lateral view (S-145346-0032).

L. FLEXOR GROUP – MEDIAN and ULNAR NERVES

pronator teres^{m}, flexor carpi radialis^{m}, palmaris longus^{u}, flexor digitorum superficialis^{m}, flexor digitorum profundus^{m+u}, flexor carpi ulnaris^{u}, epitrochleo-anconeus^{u}, pronator quadratus^{m}

M. pronator teres has the most proximal origin off the medial epicondyle. At its origin it is connected to m. biceps brachii via tough white fascia. M. pronator teres has a 7 mm-long fleshy belly which inserts via tendinous fibers into the proximal third of the cranial surface of the radius.

M. flexor carpi radialis has a 6 mm-long fleshy belly which originates from the medial epicondyle inferior to the origin for m. pronator teres. Its long thin tendon lies superficial to the median nerve, then just before the carpus it dives deep and enters a fibrous tunnel. It inserts on the palmar surface of metacarpal II.

M. flexor digitorum superficialis has an 8 mm-long fleshy belly which originates from the caudal surface of the medial epicondyle with the deep epicondylar belly of m. flexor digitorum profundus. It is a large cylindrical muscle which splits into three tendons after 1 cm. The tendons are perforated by the tendons of m. flexor digitorum profundus and insert on digits II-IV. M. flexor digitorum brevis manus for digit IV inserts on the tendon of m. flexor digitorum superficialis for digit IV.

M. palmaris longus has no bony origin, instead originating from the humeral head of origin of m. flexor carpi ulnaris. Its small, flat tendon ends at the palmar aponeurosis.

The median nerve loops around the medial side of the tendon of m. flexor digitorum superficialis and travels on its superficial surface through the carpal tunnel. It innervates the integument of digits I-III and the medial side of digit IV.

M. flexor digitorum profundus originates by three bellies. The superficial epicondylar belly of m. flexor digitorum profundus (FDPe) is broad and 9 mm long. It originates from the medial epicondyle just distal to m. flexor carpi radialis. It inserts on the medial-most edge of the flexor tendon. This belly is innervated by the median nerve. The deep epicondylar belly of m. flexor digitorum profundus (FDPd) is the smallest belly. It is deep to the superficial epicondylar belly and originates from the caudal surface of the medial epicondyle together with m. flexor digitorum superficialis. This muscle belly is only 5 mm long, and its long slender tendon crosses deep to join the flexor tendon. The ulnar belly of m. flexor digitorum profundus (FDPu) is the deepest and originates from the medial and caudal edges of the ulna. The muscle belly is broader and flatter than the others, and forms the deepest portion of the combined flexor tendon. This portion of the muscle receives ulnar innervation.

In the manus, the combined flexor tendon splits into five tendons, one to each digit. The tendons for digits II-IV perforate the tendons of m. flexor digitorum superficialis to insert on the distal phalanx, and the tendon for digit V is similarly surrounded by the tendon of insertion of m. flexor digitorum brevis manus. The tendon for digit I inserts on the distal phalanx.

M. flexor carpi ulnaris has two heads of origin. The epicondylar belly originates mostly from the superficial epicondylar belly of m. flexor digitorum profundus, but also partially from the medial epicondyle. The ulnar belly originates from the medial surface of the olecranon and is connected to m. extensor digitorum profundus by fascia. The bellies join and after 1 cm they become a tendon which inserts robustly on the pisiform.

M. epitrochleo-anconeus originates from the caudal surface of the medial epicondyle. It spans the ulnar nerve, then inserts on the medial surface of the olecranon between the insertion of m. triceps brachii caput longum and the origin of the ulnar belly of m. flexor carpi ulnaris.

The ulnar nerve travels deep to m. epitrochleo-anconeus and along the deep surface of m. flexor carpi ulnaris, travelling along the medial side of the tendon. The nerve passes medial to the pisiform and splits into superficial and deep branches. The superficial branch of the ulnar nerve provides sensory innervation to the lateral side of digit IV and both sides of digit V. The deep branch of the ulnar nerve innervates mm. lumbricale for digit V, contrahentes, and flexor digitorum breves profundus.

M. pronator quadratus is very small, no more than 5 mm long and 2 mm wide. It is found in the slight gap between the proximal radius and ulna.

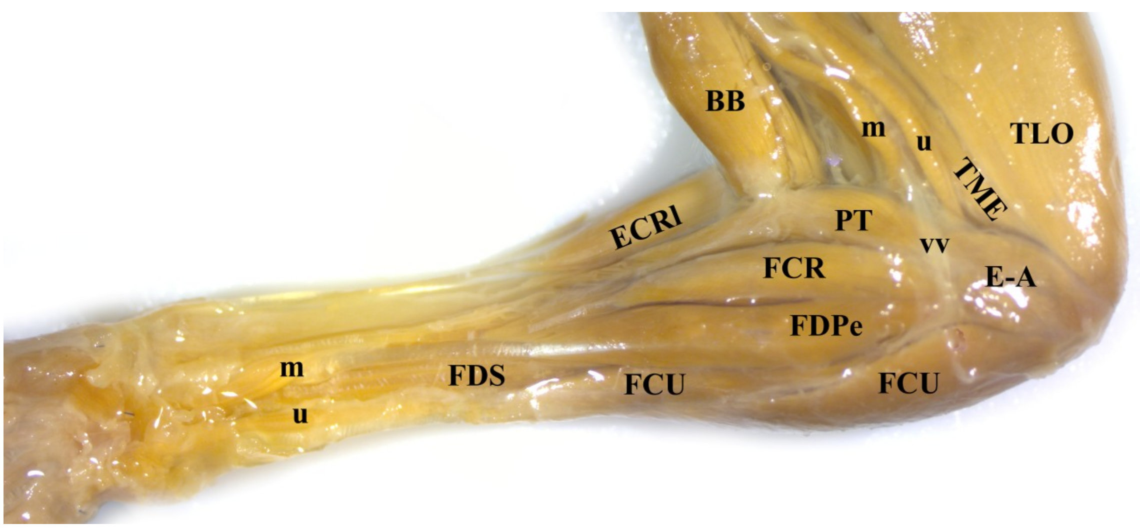


Figure 3.2B-17. Muscles originating from the medial epicondyle, medial view.
M. palmaris longus removed.

A. 

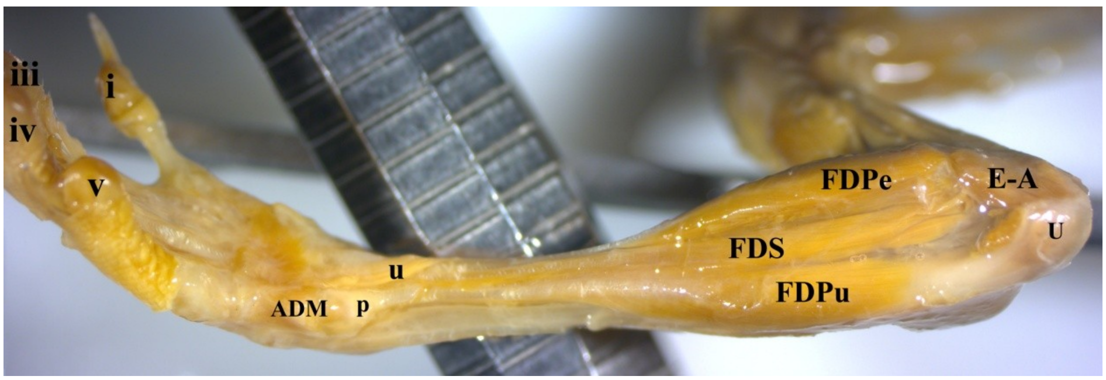
B. 

Figure 3.2B-18. Mm. flexor digitorum profundus et superficialis after removal of other flexors

A. Medial view. B. Caudal view.

M. MANUS GROUP – MEDIAN and ULNAR NERVES

mm. palmaris brevis, flexor digitorum breves manus^{m+u}, lumbricales^{m+u}, abductor digiti minimi^{u}, abductor pollicis brevis, contrahentes^{u}, flexor digitorum breves profundus^{u}

M. palmaris brevis is absent in *Microgale*.

M. flexor digitorum breves manus is quite extensive in *Microgale*. It is made of three small leaf-shaped muscles originating from the ligaments over the carpals and the flexor retinaculum. The most medial muscle ends as fascia over the lateral side of digit I. The middle muscle inserts on m. flexor digitorum superficialis tendon to digit IV. The portions for digits I and IV appear to be innervated by the median nerve, which travels just deep to these muscles. The lateral muscle inserts on the center of digit V and is innervated by the ulnar nerve.

There are four mm. lumbricales originating from the tendons of m. flexor digitorum profundus and inserting on the medial side of digits II-V. M. lumbrical for digit V is innervated by the ulnar nerve and the others by the median nerve.

M. abductor digiti minimi originates from the pisiform and inserts on the lateral side of metacarpal V. M. abductor pollicis brevis is absent in *Microgale*.

There are only two mm. contrahentes in the manus, and they are extremely thin slips of muscle. They originate from the ligaments over the carpus, deep to the flexor tendons and superficial to mm. flexor digitorum breves profundus. One inserts on the medial side of the flexor sheath around the metacarpophalangeal joint for digit V. The other inserts on the lateral side of the metacarpophalangeal joint for digit I. Jullien

(1967) noted that the contrahens for digit IV is absent in the Tenrecoidea. It is also absent in *Orycteropus*.

<u>Mm. flexor digitorum breves profundus</u> are ten in number, one pair for each metacarpal of digits I-V. They originate from the ligaments over the carpus and insert one on the lateral side and one on the medial side of the metacarpophalangeal joint of each digit. There are no opponens muscles differentiated from mm. flexor digitorum breves profundus.

A. 

B. 

C. 

Figure 3.2B-19. Right manus pre-dissection
A. Palm. B. Dorsum. C. Ulnar nerve, dorsal view.

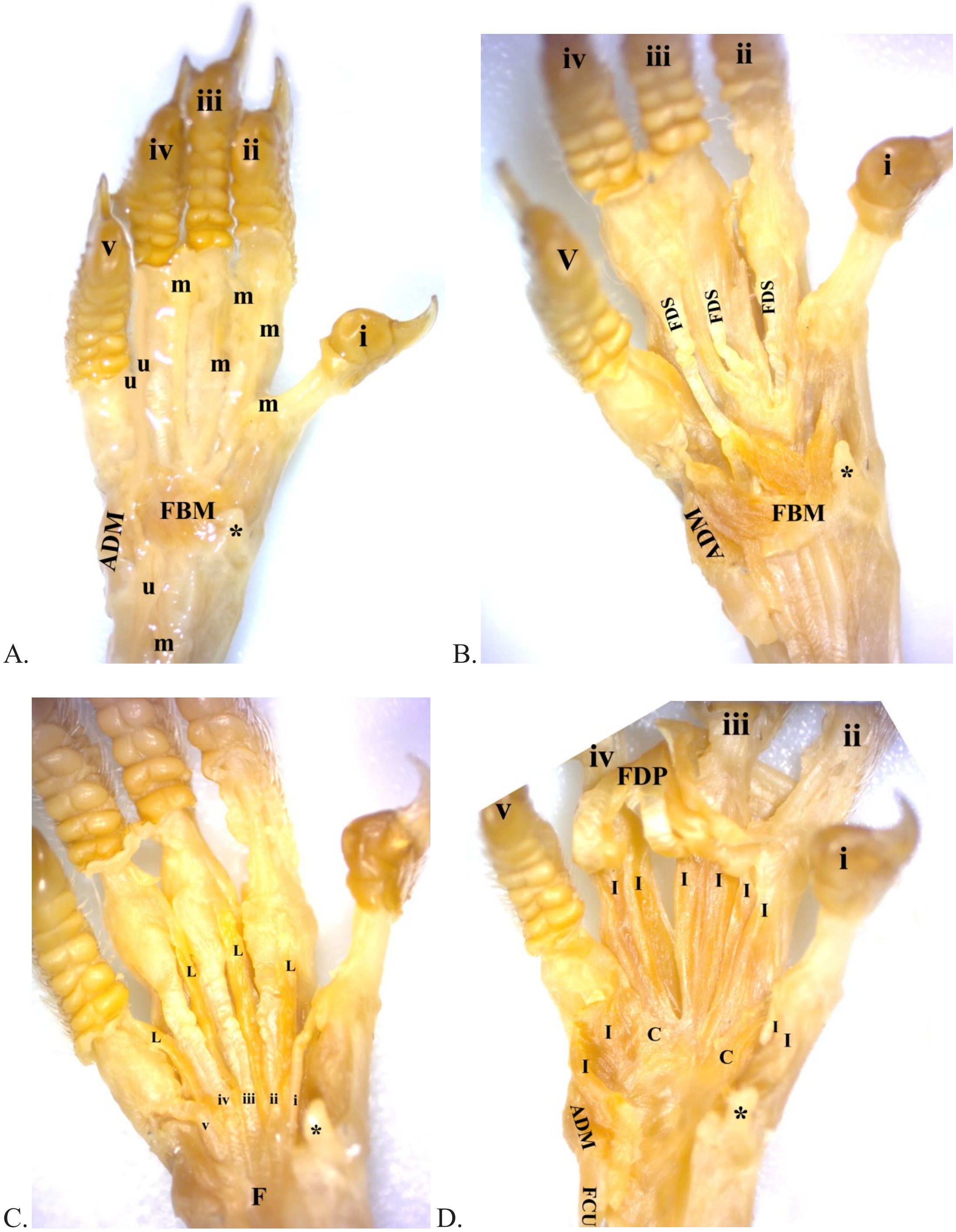


Figure 3.2B-20. Muscles of the manus

A. Median and ulnar nerves (S-144506-0020). B. Mm. flexor digitorum brevis manus and tendons of flexor digitorum superficialis (S-163109-0082). C. Mm. lumbricales and flexor tendons (S-170459-0106). D. Mm. contrahentes and flexor digitorum breves profundus (S-154246-0040).

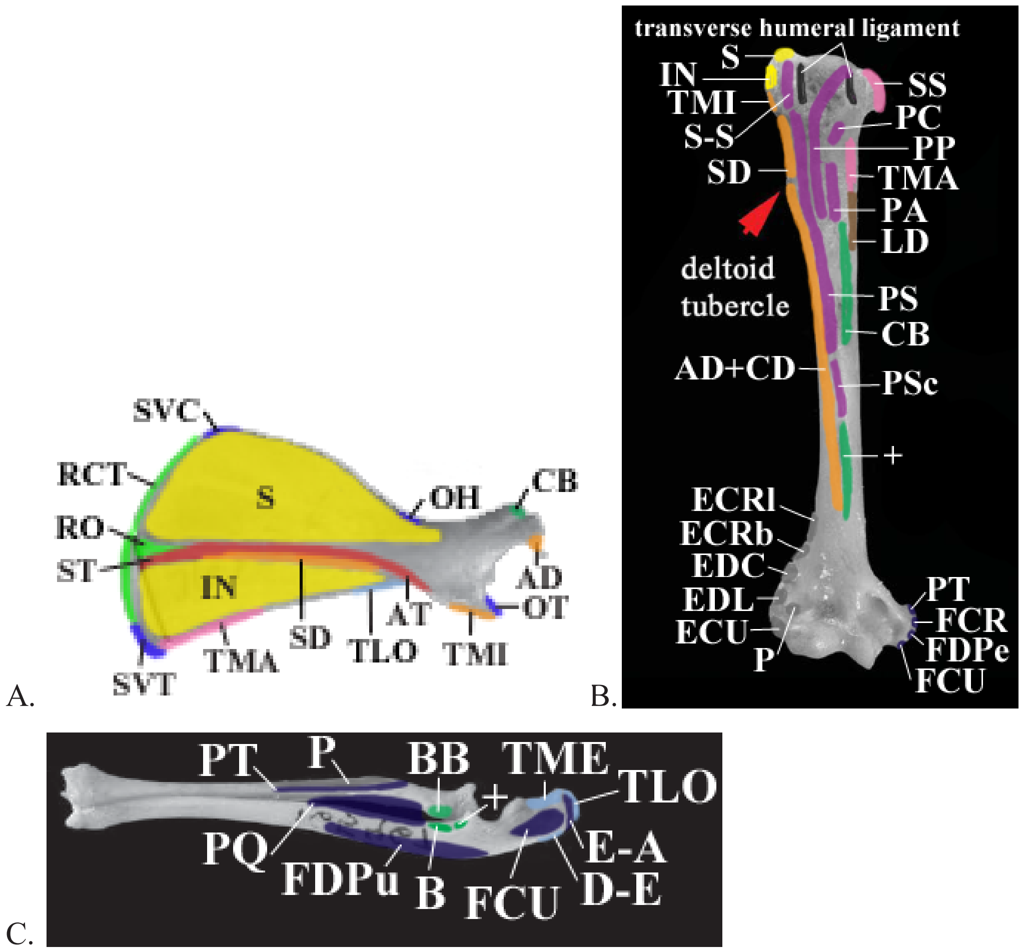


Figure 3.2B-21. Muscle attachment maps, mapped on images from Salton & Sargis (2008a).

A. Dorsal surface of the scapula. B. Cranial surface of the humerus. C. Medial surface of the radius and ulna.

[+- cubitalis, AD+CD – acromiodeltoideus and clavodeltoideus, AT – acromiotrapezius, B – brachialis, BB – biceps brachii, CB – coracobrachialis, D-E – dorso-epitrochlearis, E-A – epitrochleo-anconeus, ECRb – extensor carpi radialis brevis, ECRl – extensor carpi radialis longus, ECU – extensor carpi ulnaris, EDC – extensor digitorum communis, EDL – extensor digitorum lateralis, FCR – flexor carpi radialis, FCU – flexor carpi ulnaris, FDPe – superficial portion of flexor digitorum profundus, FDPu – ulnar head of flexor digitorum profundus, IN – infraspinatus, LD – latissimus dorsi, OT – omotransversarius, P – supinator, PA – pectoralis abdominalis, PC – panniculus carnosus, PP – pectoralis profundus, PQ – pronator quadratus, PS – pectoralis superficialis, PT – pronator teres, RCT – rhomboideus cervicis et thoracis, RO – rhomboideus capitis, SD – spinodeltoideus, S – supraspinatus, S-S – sternoscapularis, SS – subscapularis, SVC – serratus ventralis cervicis, TLO – triceps brachii caput longum, TMA – teres major, TME – triceps brachii caput mediale, TMI – teres minor]

3.2C – Afrosoricida – Chrysochloridae – *Calcochloris leucorhinus*

Due to interest in the digging mechanics of these rare fossorial mammals, there are several published descriptions of the forelimb anatomy of chrysochlorids (Dobson, 1883; Parsons, 1901; Campbell, 1938; Jullien, 1967; Puttick & Jarvis, 1977; Gasc et al., 1986). However, these descriptions are mainly of the Chrysochlorinae. There is only one previous description of a species of Amblysominae (Dobson, 1883), and the forelimb anatomy of *Calcochloris leucorhinus* has never been described.

Here I describe, for the first time, the extrinsic and intrinsic muscles of the forelimb of a female specimen of *Calcochloris leucorhinus*, the Congo golden mole (AMNH 118829), collected for the American Museum of Natural History in 1941. The right side of the face was previously dissected (Whidden, 2002), but otherwise the specimen is in excellent condition. Due to the very small size of the animal, dissections were performed under a microscope.

A.

B.


Figure 3.2C-1. Pre-dissection photographs of *C. leucorhinus*, AMNH 118829.
A. Lateral view face, left side. B. Lateral view, right side. (P5280100).

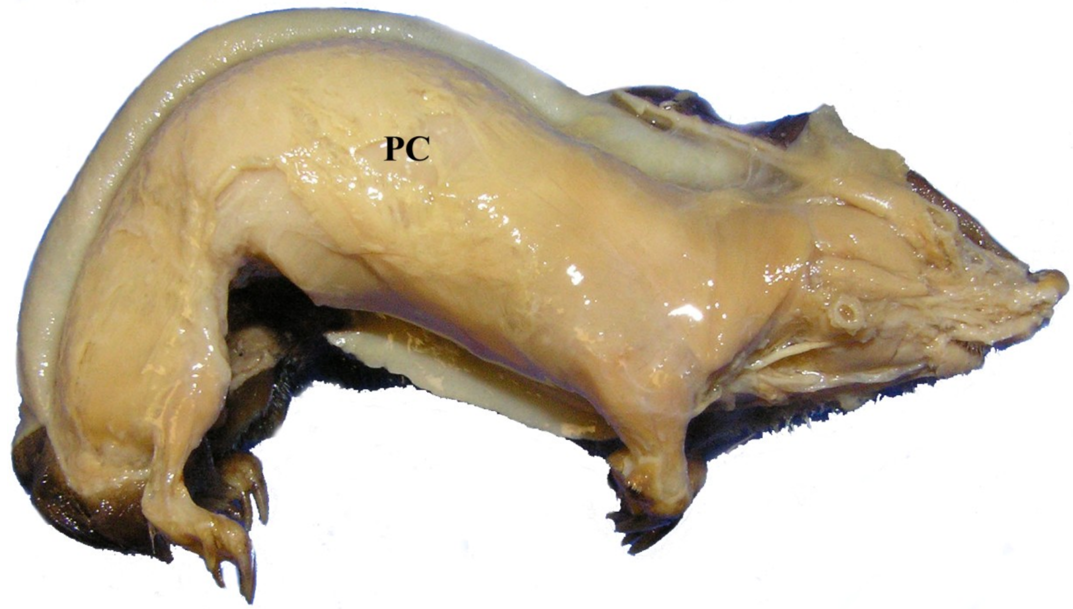
0. CUTANEOUS MUSCULATURE

mm. sphincter colli, cutaneous ventralis, dorsocutaneous

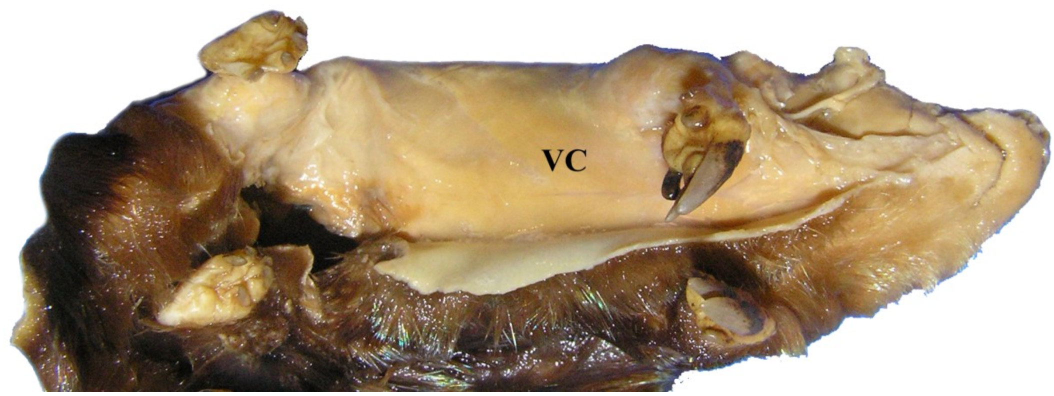
There was a superficial muscle covering m. acromiotrapezius which spanned from the occipital region to over the acromion with no bony attachment, but this muscle was reflected by Whidden (2002) when he dissected the snout muscles. It is therefore not clear what muscle this might be, labeled here as <u>m. sphincter colli</u>, though in *Chrysospalax* there is “no indication of the sterno-facialis or sphincter colli so common among mammals” (Parsons, 1901: 28). The muscle may be the “occipito-cuticulares” and “cervico-cuticulares” of Dobson (1883).

<u>M. cutaneous ventralis</u> is probably homologous with the “sterno-cuticularis” of Dobson (1883) and the “ventral panniculus” of Parsons (1901). It originates over the sternum and sweeps caudo-laterally in a wide band that sends fibers across the lateral olecranon to fuse with m. latissimus dorsi. Other fibers merge with m. panniculus carnosus along the side of the body.

<u>M. dorsocutaneous</u> seems to be absent in *Calcochloris*, but a “dorso-cuticularis” is present extending from the lumbar fascia to the skin of the shoulder in *Amblysomus* (Dobson, 1883) and *Chrysospalax* (Parsons, 1901).



A.



B.

Figure 3.2C-2. Cutaneous musculature.

A. Lateral view of (P5290001). B. Ventral view (P5290010).

[PC – panniculus carnosus, VC – cutaneous ventralis]

A. TRAPEZIUS GROUP – ACCESSORY NERVE & CERVICAL NERVE

mm. sternomastoideus, cleidomastoideus, clavotrapezius, acromiotrapezius, spinotrapezius

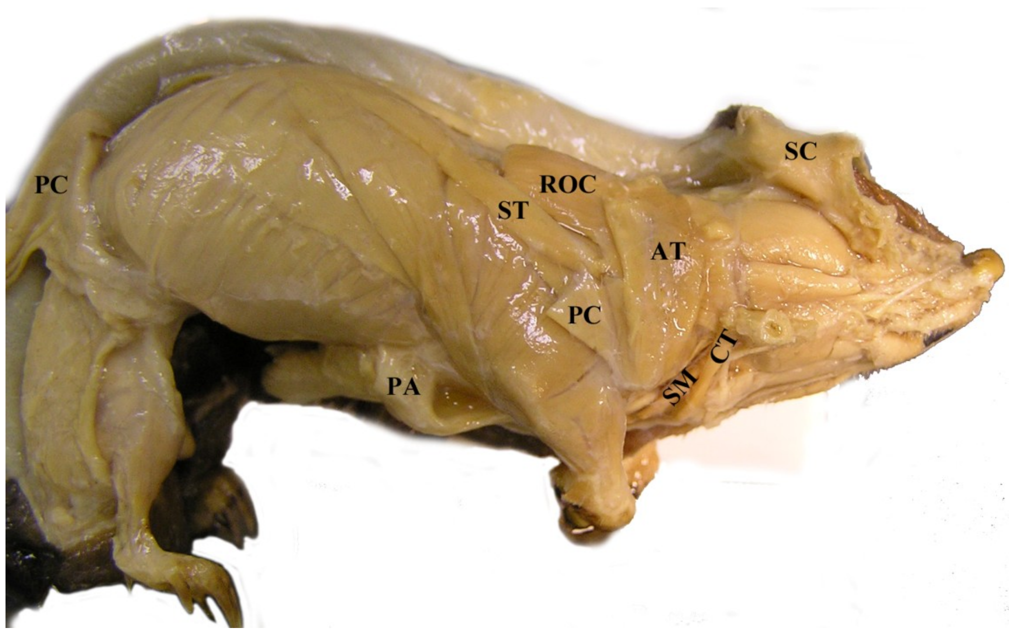
M. sternomastoideus originates just behind the external auditory meatus from the mastoid process, deep and ventral to the origin of m. clavotrapezius. The muscle is 2 mm wide and inserts on the manubrium. The external jugular vein emerges from the thorax lateral to mm. sternomastoideus, cleidomastoideus, and clavotrapezius.

M. cleidomastoideus also originates from the mastoid process, deep and slightly lateral to the origin of sternomastoideus. It runs ventrally, remaining deep to m. sternomastoideus, and inserts at the sternoclavicular joint.

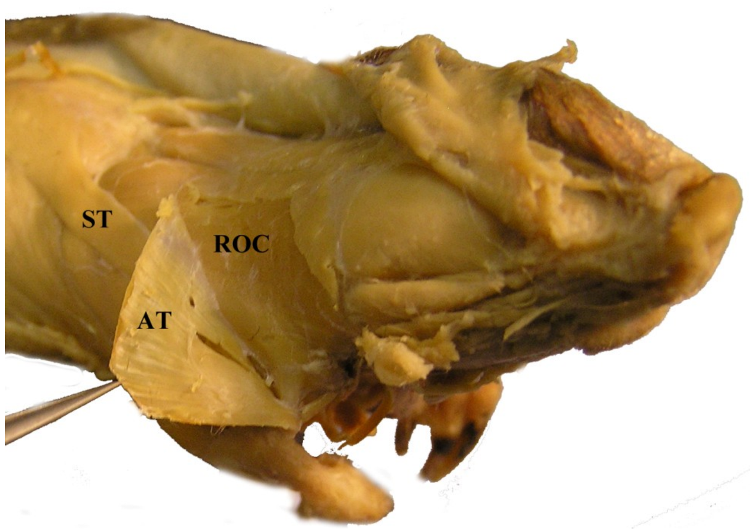
M. clavotrapezius is a very slender muscle (<1 mm) originating from the lateral occiput. It runs ventrally and inserts on the clavicle near the lateral edge of m. sternomastoideus. Unfortunately, the great auricular nerve, which should emerge just distal to m. clavotrapezius, is either destroyed due to a previous dissection of the snout (Whidden, 2002), or absent along with the pinnae. Jullien (1967) was unable to describe mm. sternomastoideus, cleidomastoideus, or clavotrapezius due to preservation issues, but my observations agree with Dobson (1883) and Parsons (1901).

M. acromiotrapezius is not very robust. It originates along the occipital crest to just above the external auditory meatus, and also from the proximal few cervical vertebrae along the dorsal midline. The muscle is flimsy and has fascial attachment to the extremely robust mm. rhomboideus deep to it. It bifurcates weakly, and the larger cranial portion inserts on the tip of the metacromion. The caudal portion inserts on the caudal edge of the metacromion dorsal to the insertion of m. panniculus carnosus and slightly onto the fascia over mm. rhomboideus.

M. spinotrapezius has a 1 cm origin from the distal thoracic vertebrae, superficial and superior to the origin of m. latissimus dorsi. The muscle is 3 cm long and narrow, at 4 mm wide. It inserts on the small caudal projections at the middle of the scapular spine, where it also has some connection with the insertion of mm. rhomboideus.



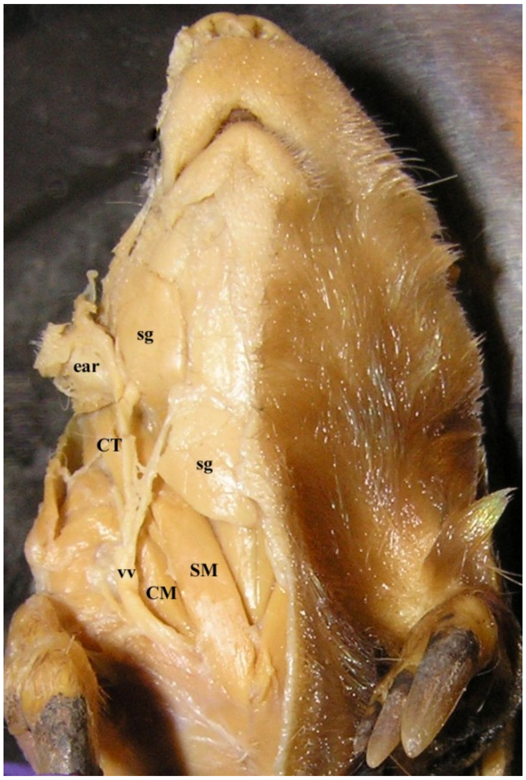
A.



B.

Figure 3.2C-3. Trapezius complex.

A. Lateral view (P3022609). B. M. acromiotrapezius reflected, showing bifid insertion (P2102469).

C. 

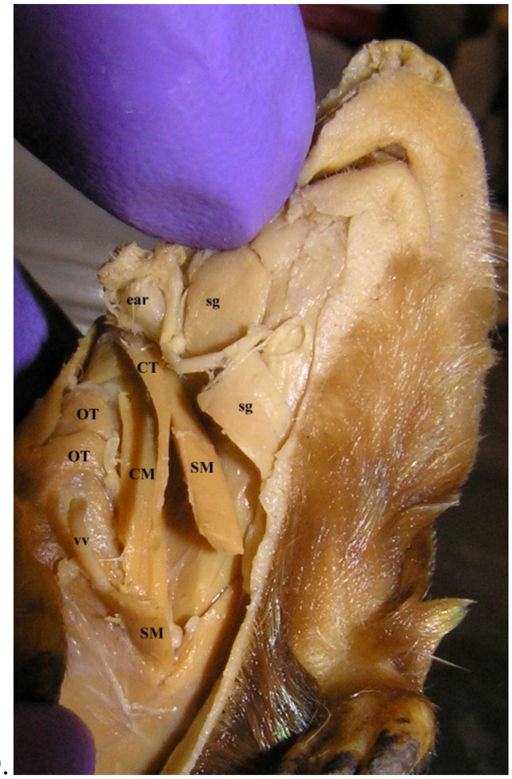
D. 

Figure 3.2C-3 continued. Trapezius complex. C. M. sternomastoideus, ventral view (P2102455). D. M. cleidomastoideus with mm. sternomastoideus and clavotrapezius reflected, ventral view (P2102462).

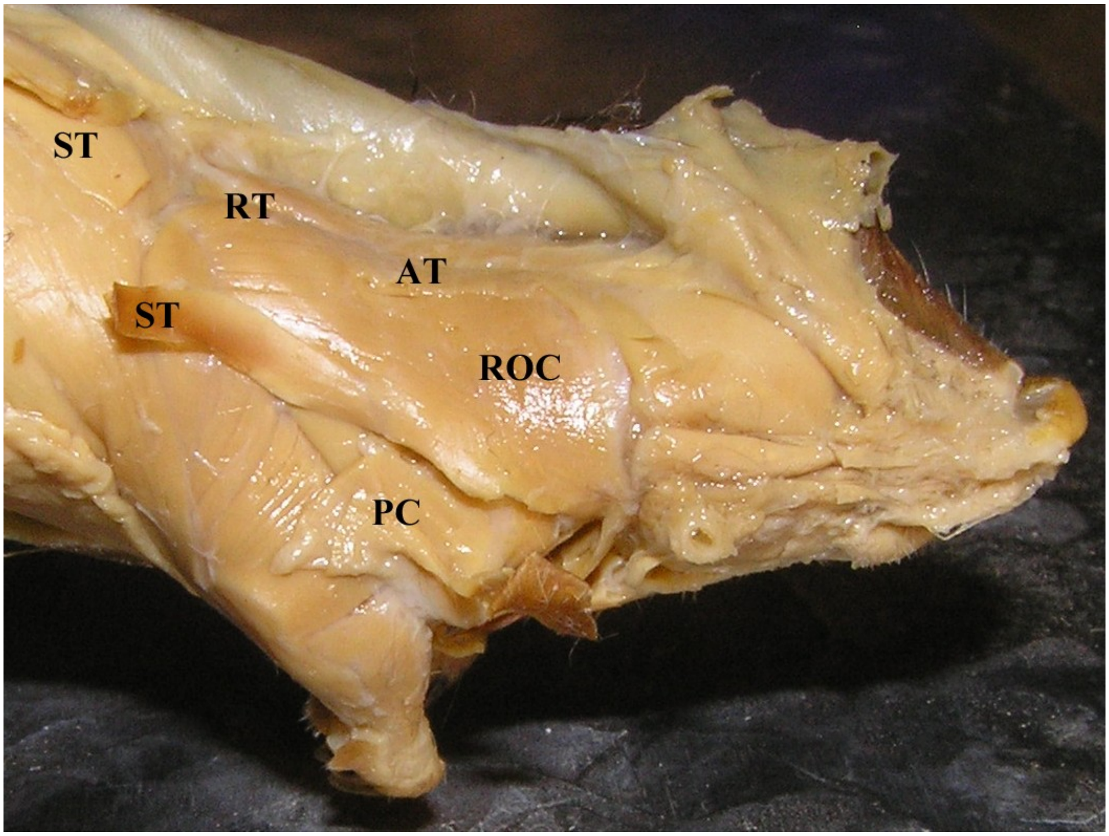
[AT – acromiotrapezius, CM – cleidomastoideus, CT – clavotrapezius, PA – pectoralis abdominalis, PC – panniculus carnosus, OT – omotransversarius (2 parts), ROC – rhomboideus capitis et cervicis, SC – sphincter colli, sg – salivary gland, SM – sternomastoideus, ST – spinotrapezius, vv – arteries]

B. RHOMBOID GROUP – DORSAL SCAPULAR NERVE

mm. rhomboideus capitis et cervicis, rhomboideus thoracis

Mm. rhomboideus capitis et cervicis are fused into one extremely robust sheet of muscle. Superficial and deep layers of mm. rhomboideus have been reported in *Amblysomus* (Dobson 1883) and *Chrysochloris* (Jullien 1967; Puttick & Jarvis 1977), but I did not observe any differentiation of the muscle sheet in *Calcochloris*. The muscle originates for 1.4 cm along the occipital crest, deep to the origin of m. acromiotrapezius and m. clavotrapezius directly behind the external auditory meatus. There are also fleshy fibers originating from the cervical vertebrae. All the fibers run in a sagittal plane, covering the majority of the scapula. Mm. rhomboideus capitis et cervicis inserts along the spine of the scapula, touching the insertion of m. spinotrapezius and also extending into a fossa at the base of the scapular spine. There is a small crest from the spine toward the caudal angle of the scapula marking the position of the insertion of mm. rhomboideus.

M. rhomboideus thoracis is a tiny muscle with a 2 mm origin along the first two thoracic vertebrae. It is only 3 mm long before it inserts on a small tubercle on the caudal end of the vertebral border of the scapula and on the deep surface of m. serratus ventralis thoracis. M. rhomboideus thoracis is fused with its partner across the dorsal midline in *Chrysospalax* (Campbell, 1938; Parsons, 1901) and *Amblysomus* (Dobson 1883), similar to m. rhomboideus thoracis in Talpidae (Dobson, 1882, 1883; Reed, 1951; Whidden, 2000), but the small muscle is clearly not fused across the vertebrae in my specimen.

A. 

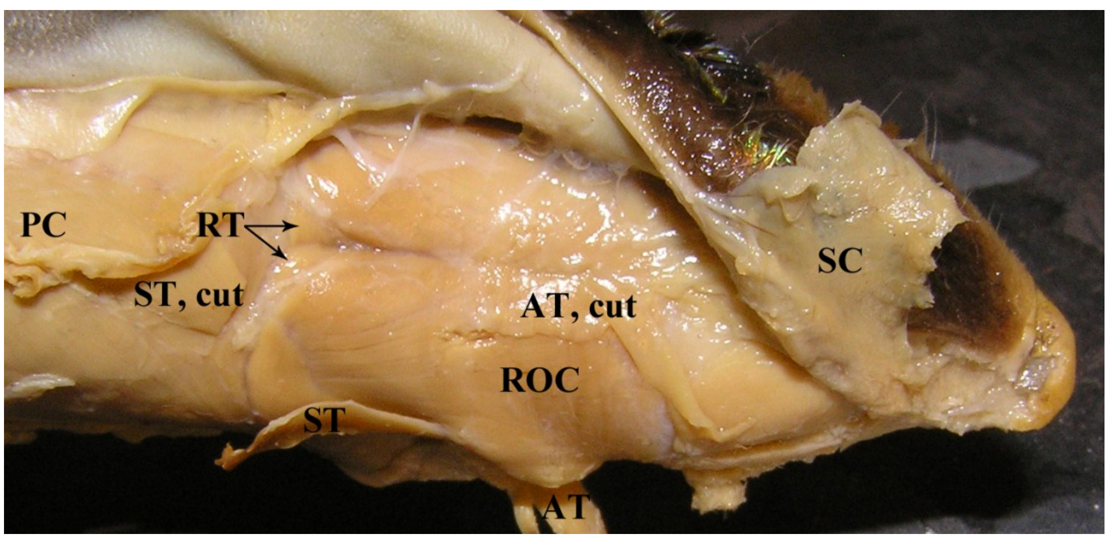
B. 

Figure 3.2C-4. Mm. rhomboideus.

A. Lateral view (P2102481). B. Dorsal view (P2102482)

C. OMO GROUP – CERVICAL NERVES, LONG THORACIC NERVE

mm. omotransversarius, omohyoideus, serratus ventralis (cervicis, thoracis)

There are two portions of m. omotransversarius muscle, both originating from the transverse process of the atlas. The ventral portion of m. omotransversarius is quite slender and inserts medial to the insertion of m. acromiotrapezius on the ventral edge of the metacromion. The dorsal portion of m. omotransversarius is larger and, overlapping the medial end of the insertion of m. serratus ventralis cervicis, inserts along the cranial edge of the acromion where there is a projection marking its insertion. Jullien (1967) described one muscle forked in its distal half in his specimen of *Chrysochloris*, but the two portions of m. omotransversarius were clearly distinct and individual in my specimen. Two portions of m. omotransversarius are also found in *Amblysomus* (Dobson, 1883) and *Chrysospalax* (Campbell, 1938; Parsons, 1901).

M. omohyoideus is absent in *Calcochloris*.

M. serratus ventralis cervicis originates for 6 mm along cervical vertebrae 3-7 and fans out to more than 1 cm almost immediately and caps the cranial border of the scapula. It inserts on the acromioclavicular joint, along the cranial edge of the spine of the scapula, and continues in a curve across the supraspinous fossa to the cranial angle of the scapula. This broad insertion of m. serratus ventralis on the dorsal surface of the scapula is quite unusual. M. serratus ventralis cervicis is about twice as thick as m. serratus ventralis thoracis, which originates via nine digitations from the proximal nine ribs, spanning 1.5 cm. It inserts along the deep surface of the vertebral border of the scapula, deep to the insertion of m. rhomboideus thoracis. The two portions of m. serratus ventralis exchange some fibers and form a vast sheet, but the muscles insert separately.

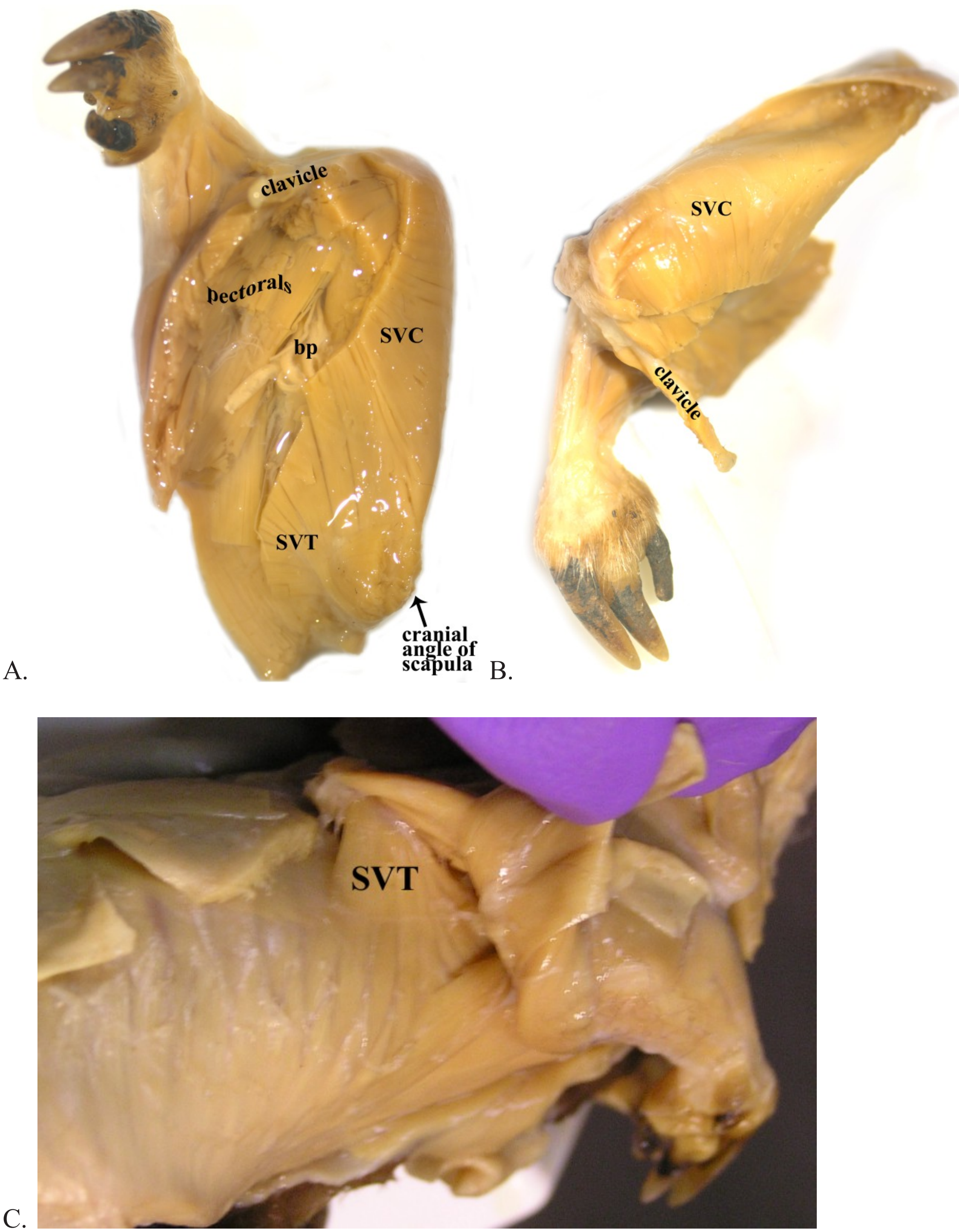


Figure 3.2C-5. Mm. serratus ventralis.

A. Deep view of insertions. B. Cranial view of insertions. C. Ventral view of the origin of m. serratus ventralis thoracis (P3022631).

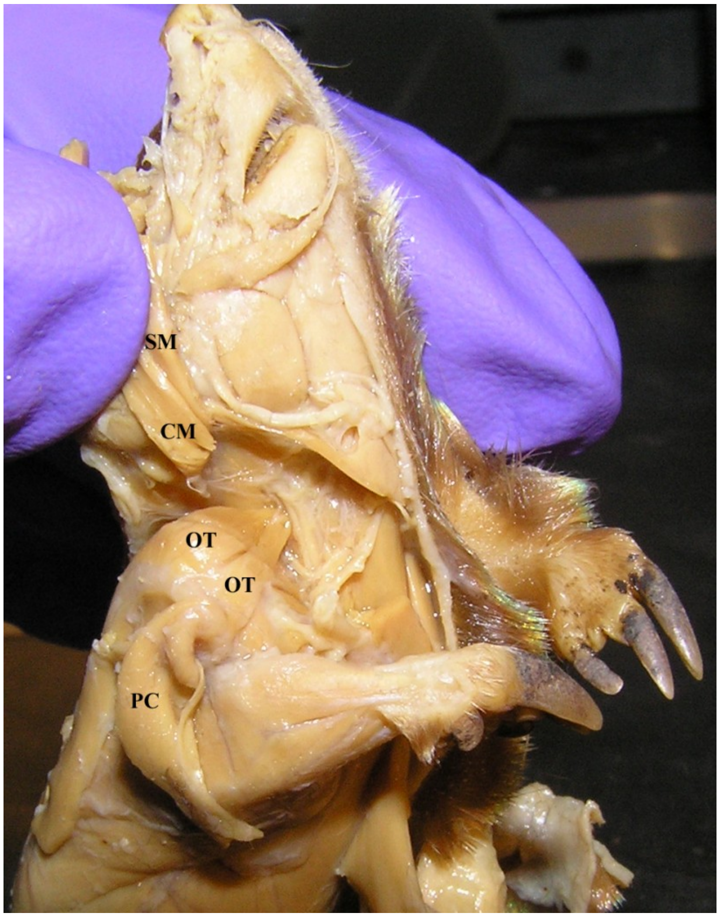


Figure 3.2C-6. The two portions of m. omotransversarius (P3022615).

D. DELTOID GROUP – AXILLARY NERVE

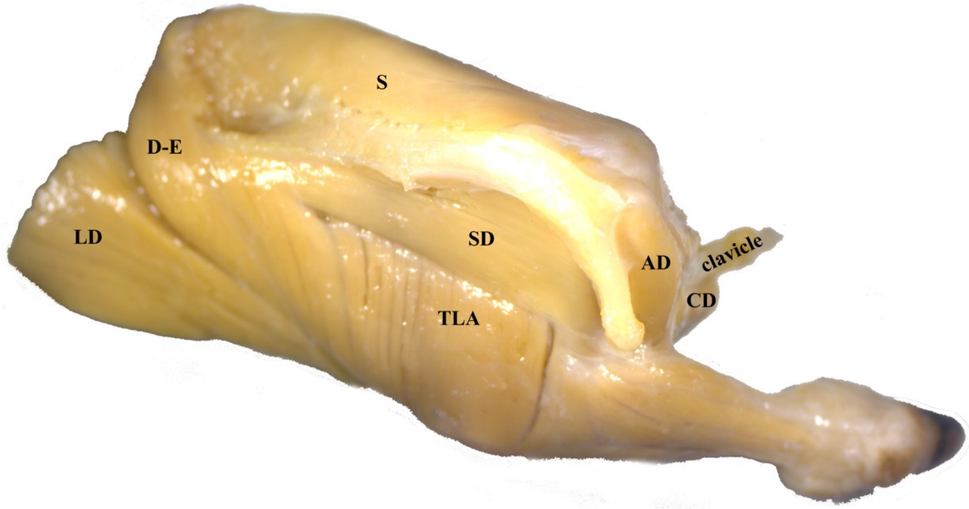
mm. clavodeltoideus, acromiodeltoideus, spinodeltoideus, teres minor

M. clavodeltoideus is extremely slight at less than 1 mm wide. It originates from the caudal edge of the middle of the clavicle. It crosses over m. acromiodeltoideus, and inserts via a tendon into a small pit in the distal craniolateral humerus. The insertion is 1 mm distal to the pectoral tubercle and lateral to the other portions of mm. deltoideus. Parsons (1901) describes mm. clavodeltoideus and acromiodeltoideus as small and fused in *Chrysospalax*, but they are separate muscles in the specimen of *Calcochloris* described here and in the *Chrysospalax* dissected by Campbell (1938).

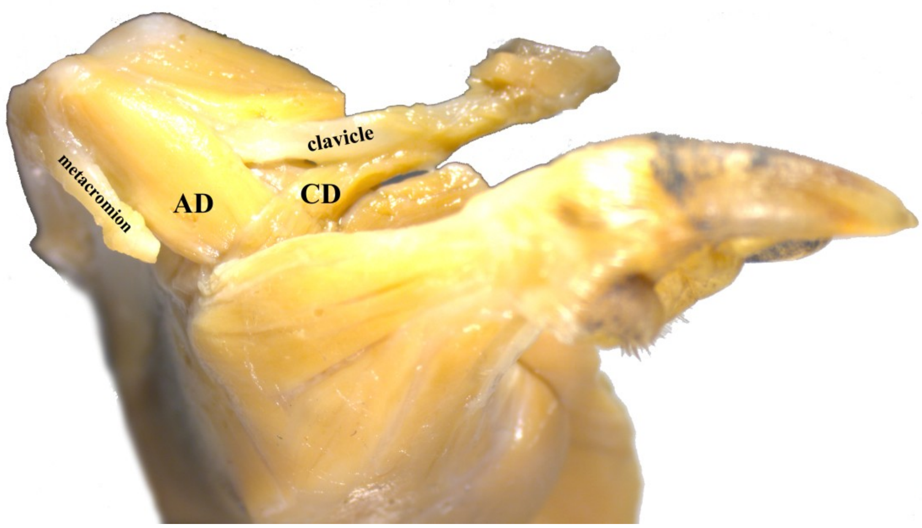
M. acromiodeltoideus is a 3 mm wide muscle originating from the acromion and also for 4 mm along the cranial and superficial surfaces of the clavicle. This claviclur origin may be the source of the confusion in Parsons (1901). M. acromiodeltoideus inserts on the distal humerus lateral to the triangular pectoral tubercle where mm. pectoralis profundus and "costo-scapularis" (=sternoscapularis) insert.

M. spinodeltoideus is very robust and originates from the proximal 1.2 cm of the caudal surface of the scapular spine and acromion, with the distal end lying deep to the origin of m. dorso-epitrochlearis. The muscle travels deep to the metacromion process and inserts for 4mm along the craniolateral aspect of the humerus.

M. teres minor is described as absent in *Chrysospalax* (Campbell, 1938; Parsons, 1901). In *Calcochloris*, it is present but very closely applied to m. infraspinatus. The two muscles originate from the deep surface of the caudal border of the spine and acromion of the scapula. They are separated superficially by a branch of the axillary nerve and this separation extends through insertion, which is via a small tendon into a fossa on the greater tuberosity.



A.



B.

Figure 3.2C-7. Mm. deltoideus.
A. Lateral view. B. Cranial view.

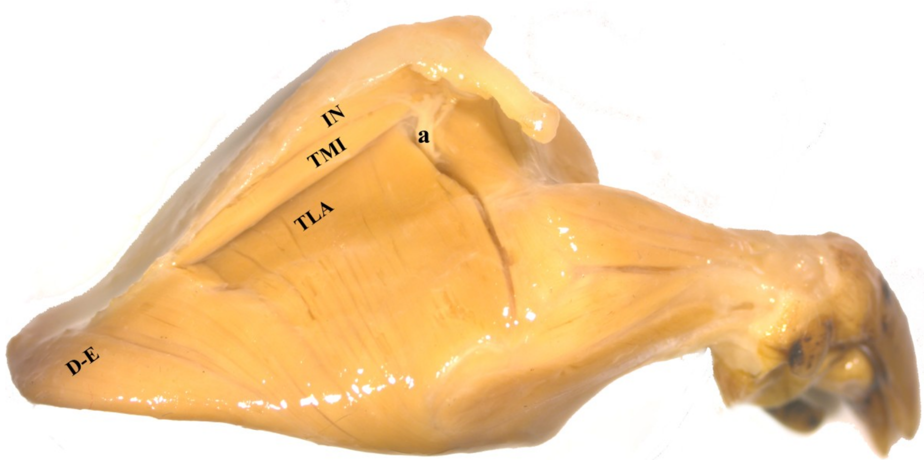


Figure 3.2C-8. Mm. teres minor and infraspinatus. Caudo-lateral view.

E. SUBSCAPULARIS GROUP – SUBSCAPULAR NERVES

mm. subscapularis, teres major

M. subscapularis is very thick and fleshy, with only a few tendinous fibers at the vertebral border of the scapula. It covers the entire subscapular fossa and hangs 5 mm below the caudal border of the scapula. It inserts via a short tendon onto the lesser tuberosity.

M. teres major originates via a small tendon from near the caudal angle of the scapula. It forms a 2.5 mm wide fleshy band which inserts deep to m. biceps brachii on the medial humerus. It is joined by a small slip of m. latissimus dorsi, indicated by the arrow in Figure 3.2C-9.

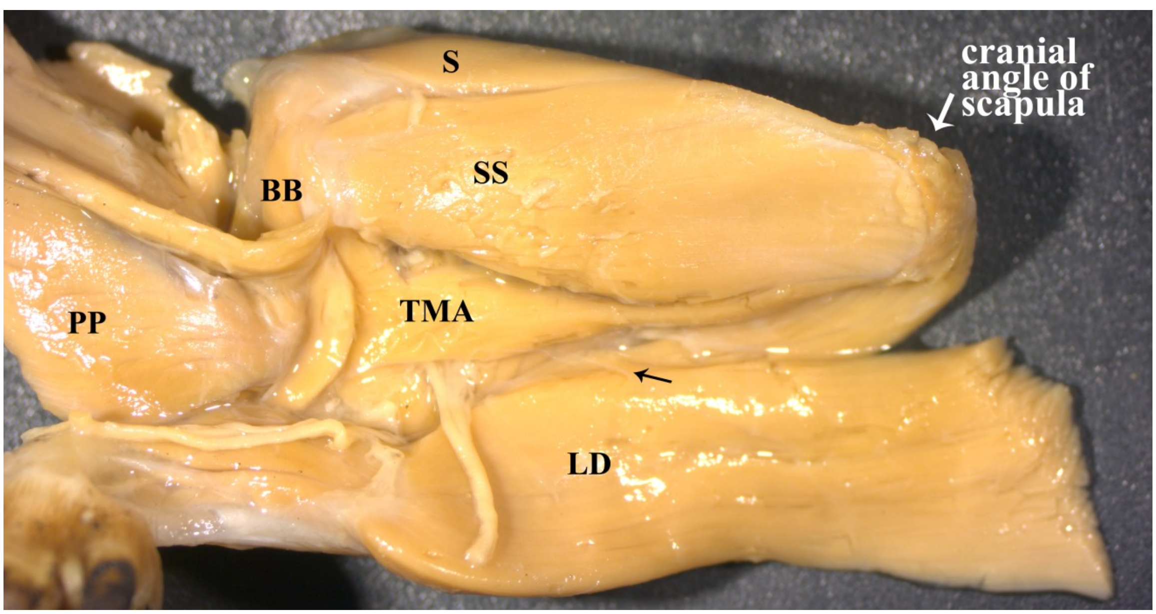
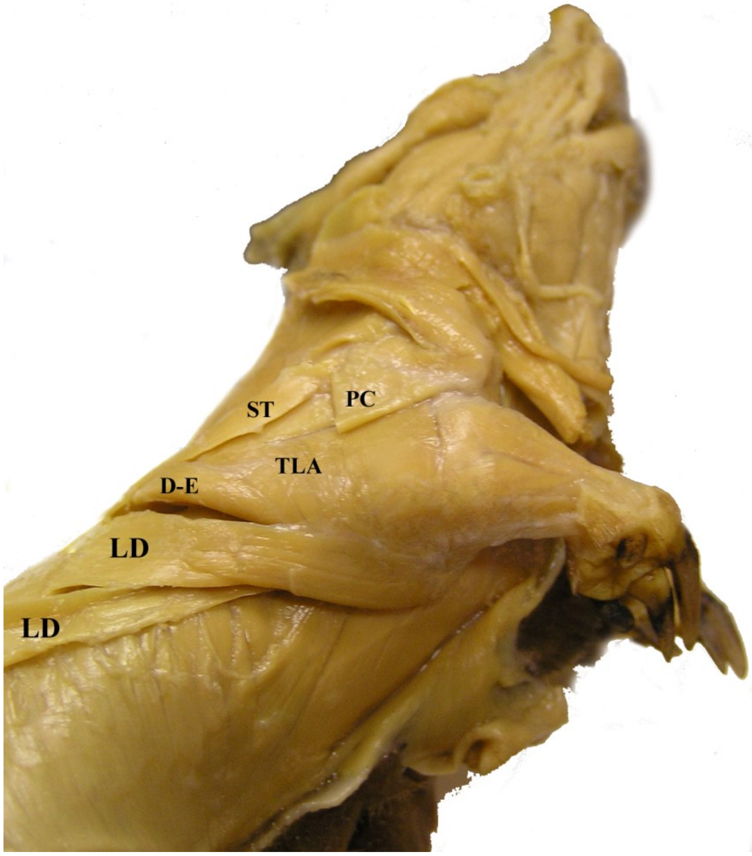


Figure 3.2C-9. Mm. subscapularis and teres major, medial view.
Small slip of m. latissimus dorsi joining m. teres major indicated by black arrow.

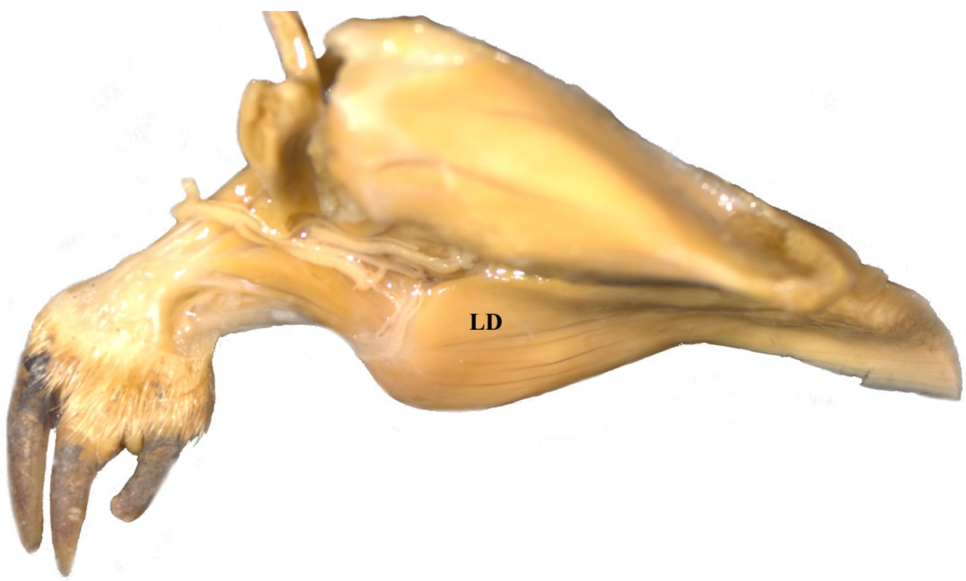
F. LATISSIMUS GROUP – THORACODORSAL NERVE

m. latissimus dorsi

Previous authors have described a curious doubled m. latissimus dorsi in chrysochlorids (Dobson, 1883; Parsons, 1901; Campbell, 1938; Jullien, 1967; Puttick & Jarvis, 1977), both portions innervated by the thoracodorsal nerve. The superficial portion of m. lastissimus dorsi originates for 1.5 cm along the thoracic vertebrae, deep to m. spinotrapezius and superficial and cranial to the origin of m. pectoralis abdominalis. The thick and powerful muscle sends a tiny slip to join with m. teres major about 7 mm proximal to the insertion of m. teres major. The remaining portion of the muscle covers the dorsal edge of m. dorso-epitrochlearis and hooks around the elbow to insert via fleshy fibers on the curved medial epicondyle. The deep portion of m. latissimus dorsi is very thin and long. Its origin is about 1 cm wide from the caudal 4 ribs, just caudolateral and deep to the origin of the superficial portion of m. latissimus dorsi. It inserts onto the deep surface of m. pectoralis profundus near its insertion on the lesser tuberosity of the humerus. The insertions of the deep portion of m. latissimus dorsi and m. pectoralis profundus form a clear fascial sac or bursa which spans the belly of m. biceps brachii, presumably acting to facilitate gliding of the muscles. The conformation of this bursa is similar to the condition in *Orycteropus*.



A.



B.

Figure 3.2C-10. M. latissimus dorsi.

A. Lateral view showing both portions of m. latissimus dorsi (P3022635). B. Insertion of superficial portion of m. latissimus dorsi, cranio-medial view.

G. PECTORALS GROUP – PECTORAL NERVES

mm. panniculus carnosus, pectoralis superficialis, pectoralis profundus et sternoscapularis, pectoralis abdominalis, subclavius

M. panniculus carnosus is homologous with the "acromio-cuticularis" of Dobson (1883) and Parsons (1901). It is made up of muscle fibers that parallel the vertebral column, extending in an arc from the rump and lateral thigh to an insertion on the caudal edge of the metacromion process.

The proximal half of m. pectoralis superficialis is covered by m. cutaneous ventralis and its caudal corner by m. serratus ventralis thoracis. Once the cutaneous musculature is removed, m. pectoralis superficialis is visible as a broad 2 mm-thick sheet of muscle stretching from the manubrium, deep to the insertion of m. sternomastoideus, for 3 cm along the midline of the sternum. It inserts medial to mm. deltoideus on the distal end of the lateral surface of the humerus. Jullien (1967) describes an anterior and posterior part of m. pectoralis superficialis in *Chrysochloris*, and the muscle appears to be divided into two layers near its insertion in this specimen of *Calcochloris*.

Mm. pectoralis profundus et sternoscapularis are mostly fused at origin into a robust cylinder with a radius of 4 mm which originates from the ribs and sternum deep and lateral to the origin of m. pectoralis superficialis. There is some fusion with the deep surface of m. pectoralis superficialis, but the fibers are at slightly different angles. Campbell (1938) described a fused m. pectoralis superficialis et profundus in *Chrysospalax*, but Jullien (1967) and Dobson (1883) give separate descriptions for the two muscles in *Chrysochloris* and *Amblysomus*. M. pectoralis profundus et sternoscapularis passes deep to the clavicle, where the cranial fibers, which represent m.

sternoscapularis, insert fleshily on the lateral third of the clavicle and via clear tendinous tissue over the greater tuberosity and the insertion of m. supraspinatus. The remaining muscle fibers, which thus represent m. pectoralis profundus, continue on to insert on the lesser tuberosity, arc over the belly of m. biceps brachii, and insert onto the large triangular tubercle on the distal craniolateral humerus. This situation is very similar to the pectorals in *Orycteropus* and in *Potamogale*. Dobson (1883) erroneously includes both m. latissimus dorsi ("dorsal part") and m. clavodeltoideus ("clavicular pectoral") in his description of mm. pectoralis of *Amblysomus*.

M. pectoralis abdominalis is a small and thick muscle which originates from one mid-thoracic rib, lateral to the origin of the m. pectoralis profundus et sternoscapularis. This muscle ends as fascia in the axilla.

M. subclavius is a tiny slip of muscle deep to m. sternoscapularis. It originates from the manubrium and inserts on the deep surface of the lateral third of the clavicle.

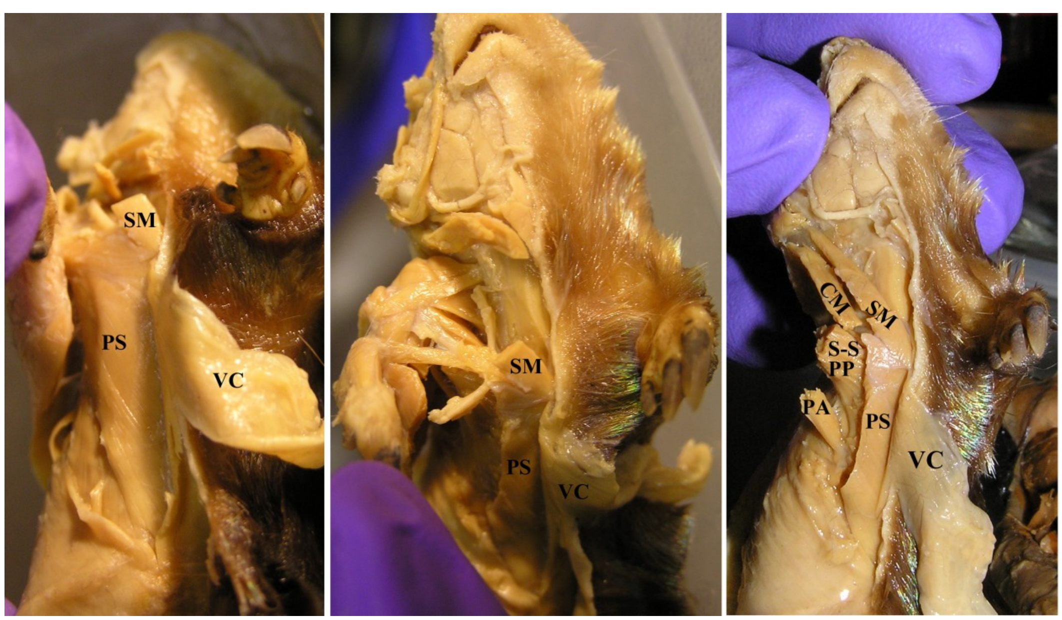
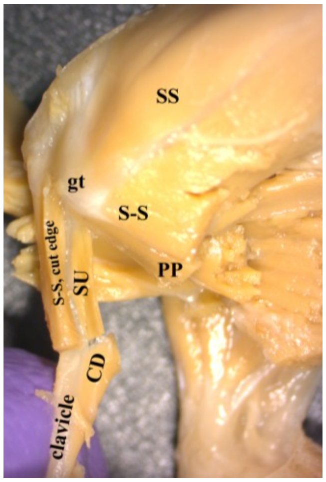
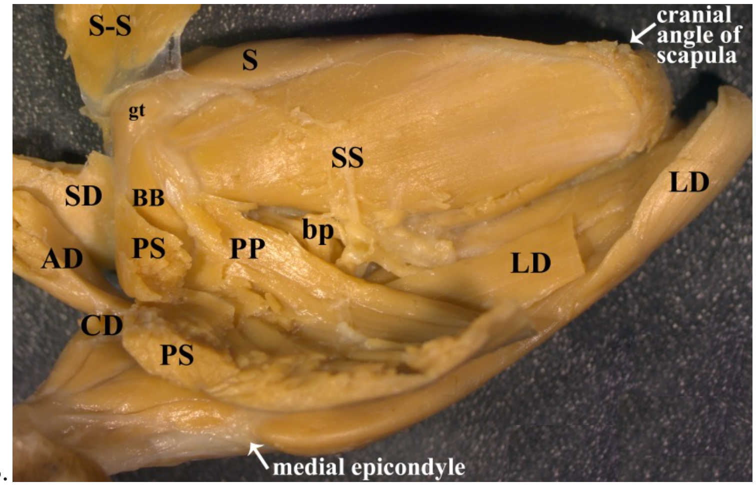


Figure 3.2C-11. Mm. pectoralis, ventral view.

A. 

B. 

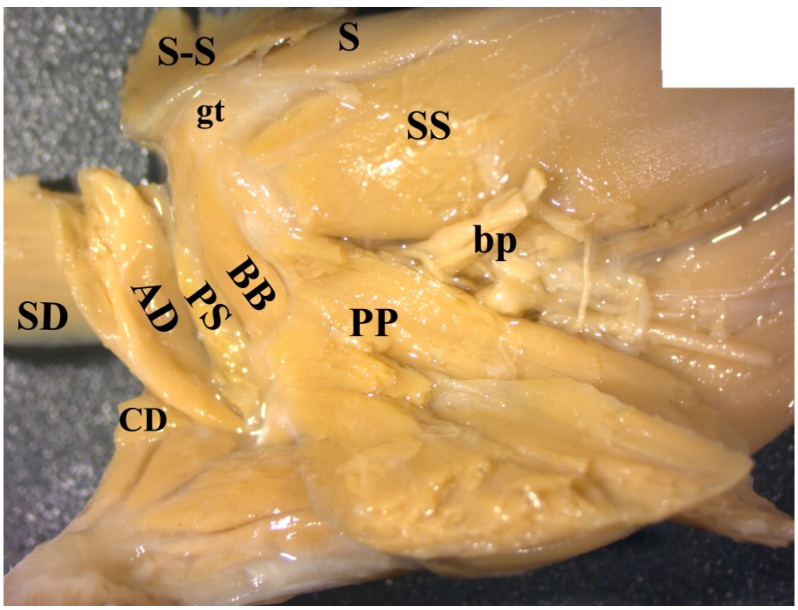
C. 

Figure 3.2C-12. Insertions of mm. deltoideus and pectoralis.

A. Insertions on the clavicle, cranio-medial view (S-114149-0007). B. Clavicle removed, showing attachments of mm. pectoralis and deltoideus, medial view. C. M. pectoralis superficialis removed showing broad insertion of m. pectoralis profundus, medial view.

H. BICEPS GROUP – MUSCULOCUTANEOUS NERVE

mm. coracobrachialis, biceps brachii, brachialis, cubitalis

M. coracobrachialis is either absent or may be a small slip of tendon that inserts on the insertion of m. pectoralis profundus at the lesser tuberosity.

M. biceps brachii has a single belly which originates via a tendon from the supraglenoid tubercle. It becomes fleshy almost immediately after it exits the intertubercular groove. The muscle is bizarrely "s-shaped" and passes deep to the projecting triangular pectoral tubercle on the distal humerus. M. biceps brachii inserts via a tendon onto the caudo-medial surface of the neck of the radius. Campbell (1938) referred to m. biceps brachii inserting on both the radius and ulna in *Chrysospalax*.

M. brachialis originates from the deep fossae found just medial and lateral to the head of the humerus. The muscle travels down the lateral side of the arm and becomes a tendon in the cubital fossa. Its insertion is 1 mm-wide on the medial ulna.

Just medial to the insertion of m. brachialis is an additional small slip of muscle, here named m. cubitalis, extending from the distocranial aspect of the humerus to the ulna. It is unclear which biceps group muscle this slip is related to, or what nerve innervates it. However, I also found m. cubitalis in the hyracoids and *Microgale*. Domning (1978) noted a "check ligament" in *Trichechus*, Miall & Greenwood (1878b) observed a similar ligament in *Elephas*, and Humphry (1868) noted a few fibers of m. biceps brachii passing with m. brachialis to the ulna in the aardvark. I suspect that these comments all refer to this vestigial slip of muscle, which merits further study of its developmental origin and innervation.

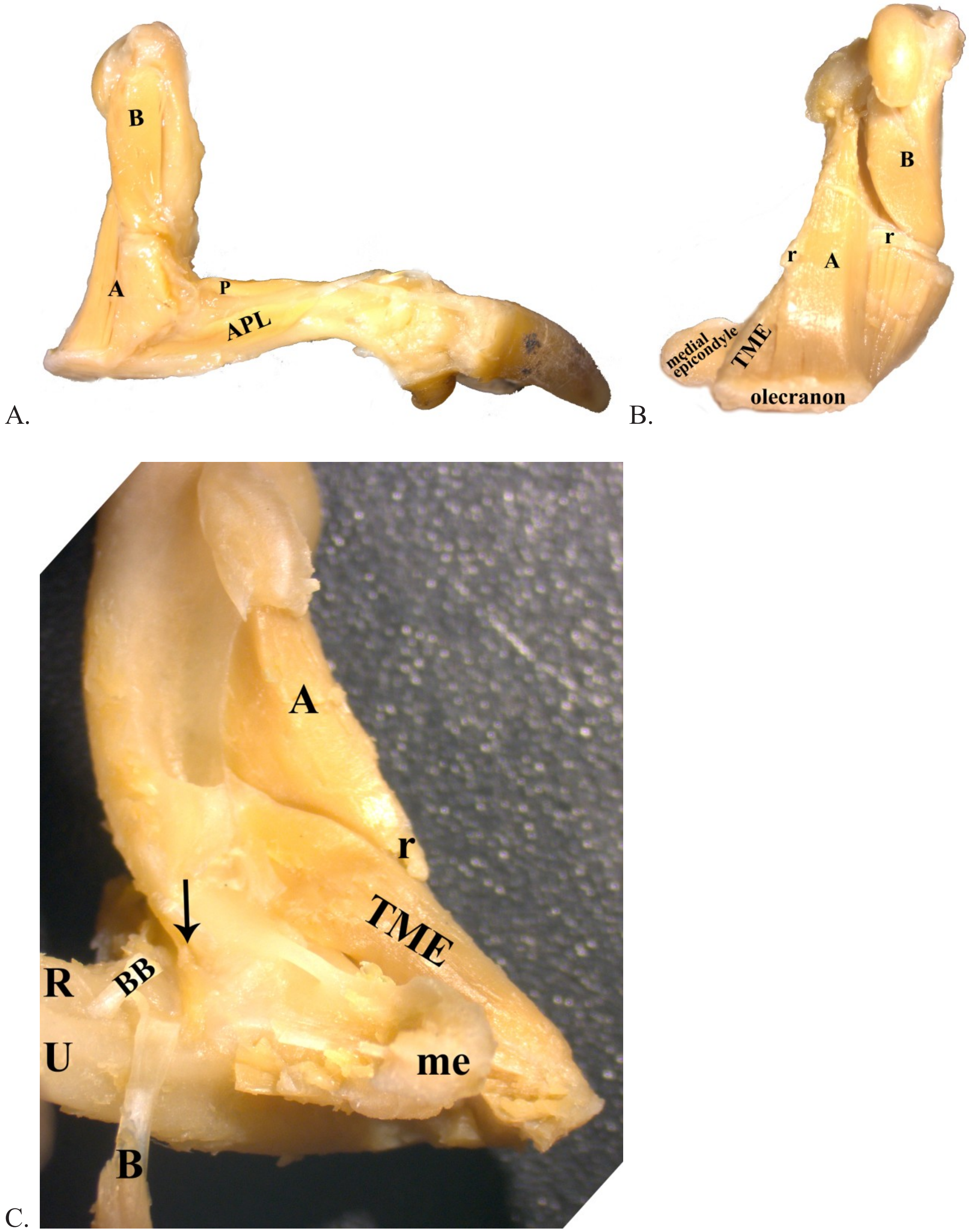


Figure 3.2C-13. Muscles of the biceps group.

A. M. brachialis, lateral view. B. M. brachialis, caudal view (SNAP-163751-0011) C. Biceps group insertions. Arrow indicates additional slip of muscle from the humerus to the ulna (SNAP-164239-0017).

I. SPINATI GROUP – SUPRASCAPULAR NERVE

mm. supraspinatus, infraspinatus

M. supraspinatus originates from the cranial border of the scapula and from the lateral half of the supraspinous fossa, in the area where the enlarged m. rhomboideus capitis et cervicis inserts on the medial half of the supraspinous fossa. It crosses deep to a huge coraco-acromial ligament and inserts fleshily on the greater tuberosity.

M. infraspinatus is very closely associated with m. teres minor but a division is visible between the two muscles. The muscles are not very accessible due to their small size and position under the scapular spine, but m. infraspinatus is the smaller more proximal of the two. They originate via fleshy fibers from the deep surface of the caudal border of the scapular spine and the infraspinous fossa, and insert via a small tendon into a fossa on the lateral greater tuberosity.

J. TRICEPS GROUP – RADIAL NERVE

mm. dorso-epitrochlearis, triceps brachii (caput laterale, caput mediale, caput longum), anconeus

Other authors have confounded m. dorso-epitrochlearis with mm. triceps brachii (Dobson, 1883; Parsons, 1901; Campbell, 1938; Jullien, 1967; Puttick & Jarvis, 1977). M. dorso-epitrochlearis is innervated by the radial nerve in *Calcochloris*, and is probably originally derived from mm. triceps brachii (Diogo et al., 2009). It originates in two sections which are split by the origin of mm. infraspinatus and teres minor. The bigger section originates from the cranial surface of the vertebral border of the scapula, and the smaller section from the caudal border of the scapula in connection with m. triceps brachii caput laterale. This is similar to the condition in *Orycteropus* and in *Elephas* (Miall & Greenwood, 1878; Shindo & Mori, 1956; Nielsen, 1965). The two portions fuse and m. dorso-epitrochlearis inserts on the tip of the medially curved olecranon.

In *Calcochloris*, there are four heads of triceps brachii, as there are two completely separate portions of m. triceps brachii caput longum. M. triceps brachii caput longum superficialis is not visible in lateral view as it is obscured by the enlarged m. triceps brachii caput laterale which has migrated to the scapula. It has a 5 mm fleshy origin from the middle of the caudal border of the scapula. It inserts on the tip of the olecranon, deep to m. dorso-epitrochlearis. M. triceps brachii caput longum profundus has a 1.5 mm fleshy origin from the neck of the scapula. It inserts on the caudal curve of the olecranon, deep to the insertion of m. triceps brachii caput laterale and lateral to the insertion of m. triceps brachii caput longum superficialis.

M. triceps brachii caput laterale has shifted its origin to the scapula, for 5.5 mm along the caudal border. The muscle is broad and fleshy, although there are a few tendinous fibers near the neck of the scapula. There are also some shiny tendinous fibers on the deep surface of the muscle near its insertion on the lateral olecranon. Those tendinous fibers glide over the insertion of m. triceps brachii caput longum profundus, although there is a small amount of fusion between the two bellies.

M. triceps brachii caput mediale is small and originates from the medial humerus deep to the insertion of m. teres major and medial to the belly of m. anconeus. It inserts on the medial surface of the olecranon.

M. anconeus is large and originates from the fossa on the base and side of the lesser tuberosity and also from the glenohumeral joint capsule. It travels from the proximomedial side of the humerus to the lateral side of the ulna, where it inserts on the curve of the olecranon and the caudal and lateral surfaces of the lateral epicondyle.

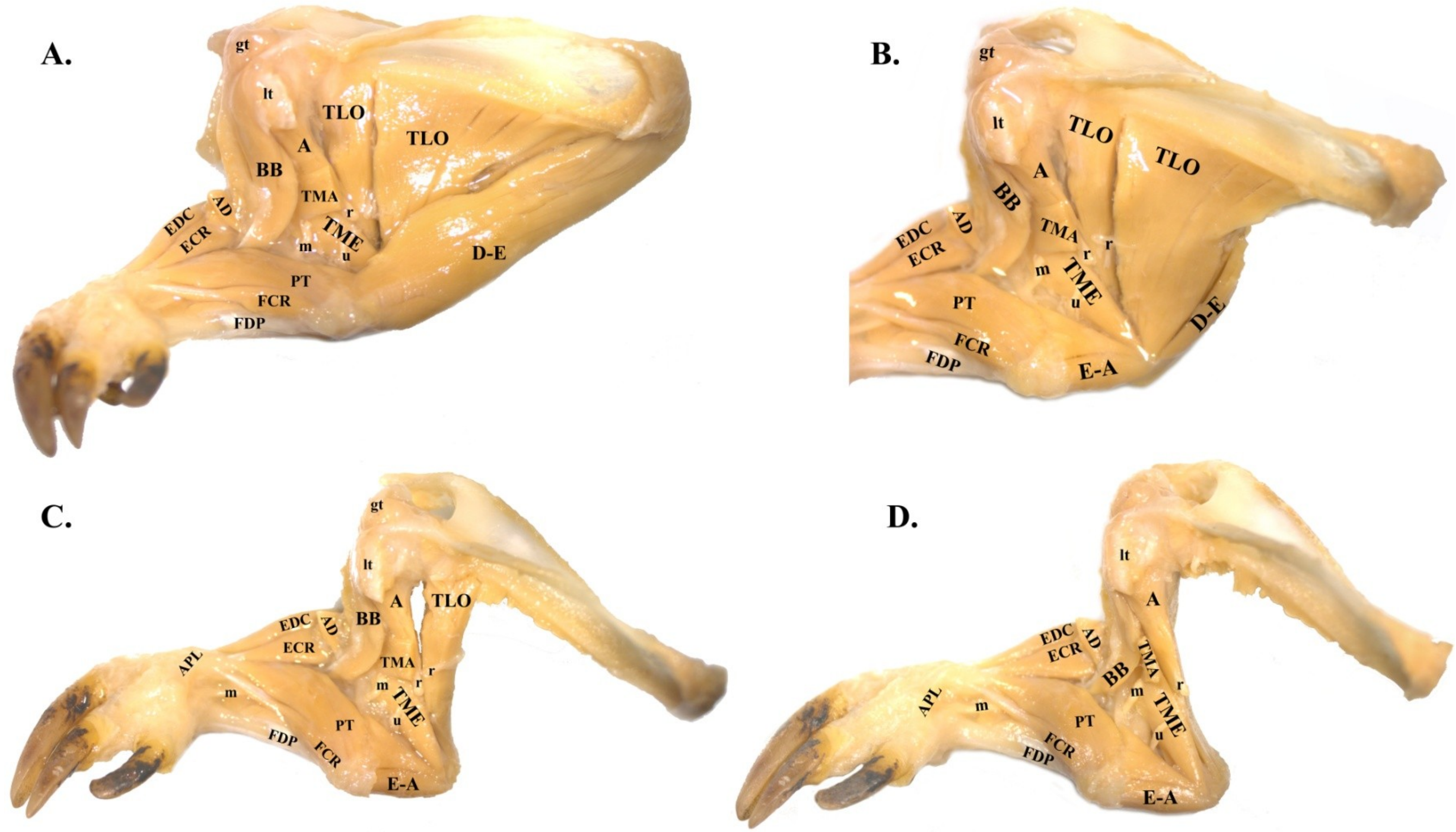


Figure 3.2C-14. Mm. triceps brachii, anconeus, and dorso-epitrochlearis, medial view.

A. All muscles intact. B. M. dorso-epitrochlearis removed. C. M. triceps brachii caput longum profundus removed. D. M. triceps brachii caput longum superficialis removed.

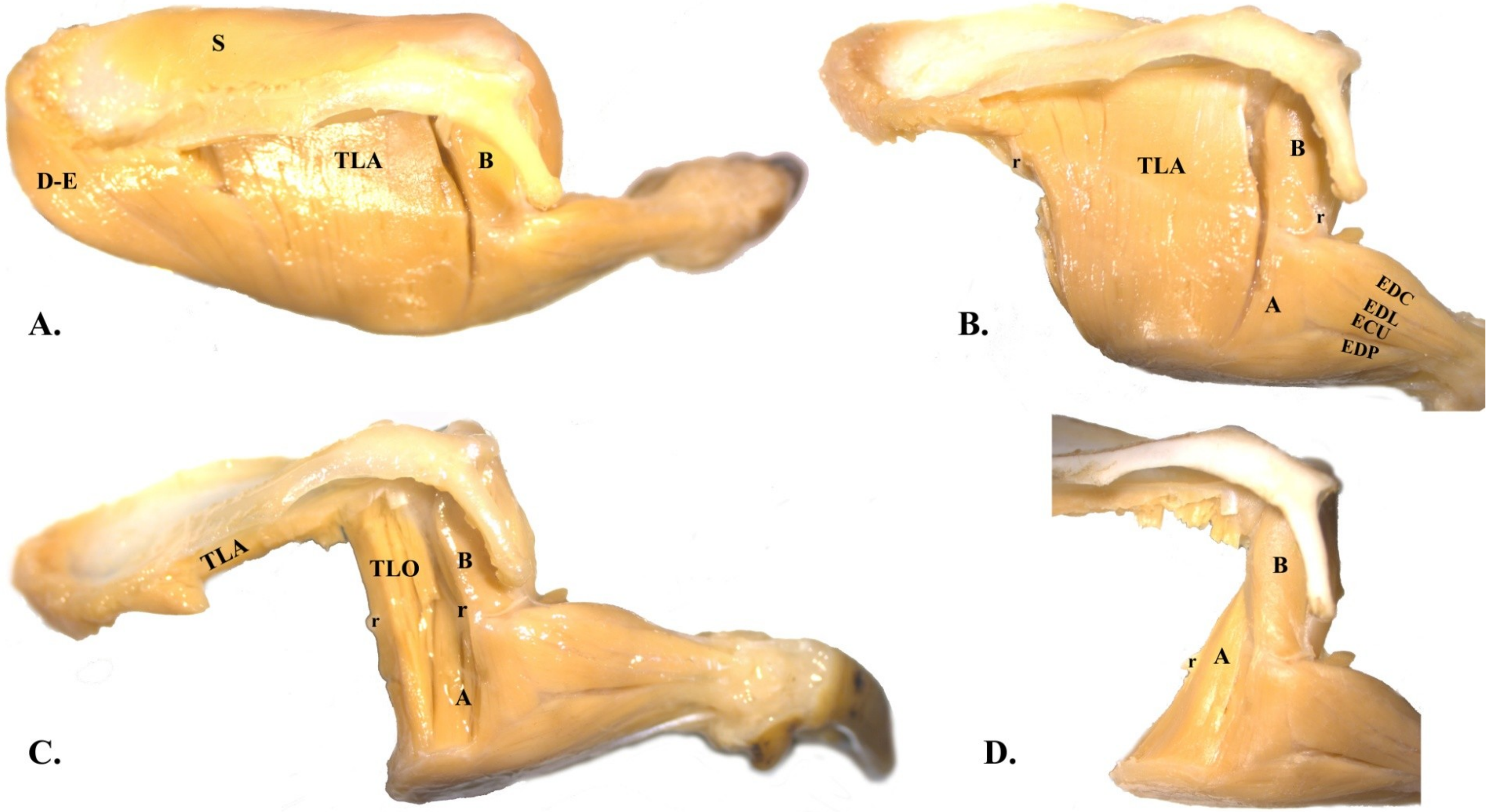


Figure 3.2C-15. Mm. triceps brachii, anconeus, and dorso-epitrochlearis, lateral view.

A. All muscles intact. B. M. dorso-epitrochlearis removed. C. M. triceps brachii caput laterale and caput longum profundus removed. D. M. triceps brachii caput longum superficialis removed.

K. EXTENSOR GROUP – RADIAL NERVE

mm. brachioradialis, extensor carpi radialis, extensor digitorum communis, extensor digitorum lateralis, extensor carpi ulnaris, supinator, abductor pollicis longus, extensor digitorum profundus

M. brachioradialis is absent in *Calcochloris*.

M. extensor carpi radialis consists of a single belly that originates from the proximal lateral epicondyle, deep to and almost completely hidden proximally by the origin of m. extensor digitorum communis. The fleshy muscle becomes a tendon, passes deep to m. abductor pollicis longus, crosses the carpus just lateral to a small crest on the cranial surface of the distal radius, and inserts on the radial side of the base of metacarpal III. An insertion on metacarpal III is also noted for *Chrysospalax* (Parsons, 1901) and *Chrysochloris* (Jullien, 1967), whereas an insertion on the base of metacarpal II is reported for *Amblysomus* (Dobson, 1883), *Eremitalpa* (Gasc et al., 1986), and *Chrysochloris* (Puttick & Jarvis, 1977).

M. extensor digitorum communis has the most proximal and superficial origin from the lateral epicondyle, and it is fused at its origin with m. extensor digitorum lateralis. The muscle develops two bellies in the middle of the forearm, which become tendons and travel deep to a strong retinaculum along with the deeper tendon of m. extensor digitorum profundus. The tendons fuse briefly over the base of metacarpal III, and there is a small sesamoid inside the tendon at that point. At the sesamoid, the tendon splits into large and small tendons. The larger tendon inserts on a tubercle on the dorsal aspect of the base of the distal phalanx of digit III. The small tendon splits again after a few millimeters, with most of the tendon inserting on the base of the distal phalanx of digit II and only a tiny sliver of tendon extending across the dorsum of the manus to insert on the distal phalanx of digit I. A tendon to digit I has not previously been reported; other descriptions report m. extensor digitorum communis inserting on either digits III+IV (Dobson, 1883; Parsons, 1901) or digits II+III (Jullien, 1967; Puttick & Jarvis, 1977; Gasc et al., 1986).

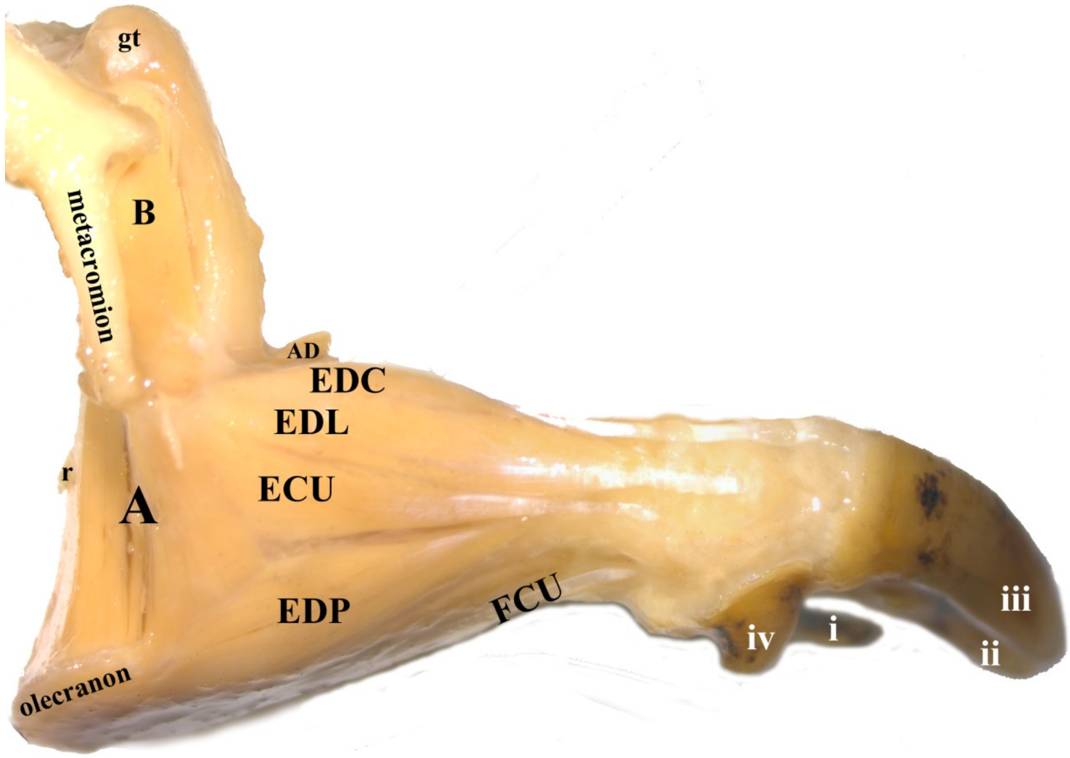
M. extensor digitorum lateralis originates from the lateral epicondyle just distal to and fused with m. extensor digitorum communis. It has a wide fleshy belly up to the carpus, where it becomes tendinous and travels deep to a small retinaculum. Unfortunately, the retinaculum for m. extensor digitorum lateralis was accidentally damaged during skinning and is not pictured here. Other authors have noted its presence in other chrysochlorids (Puttick & Jarvis, 1977; Gasc et al., 1986). A similar retinaculum is found spanning m. extensor digitorum lateralis in *Orycteropus*. Its flat tendon inserts on the ulnar side of the base of metacarpal III. Jullien (1967) noted an insertion on metacarpals III-IV in *Chrysochloris*, whereas most agree that m. extensor digitorum lateralis inserts only on metacarpal IV in other chrysochlorids (Dobson, 1883; Puttick & Jarvis, 1977; Gasc et al., 1986). Parsons (1901) noted an insertion on either digit IV or digit V in *Chrysospalax*, which is puzzling as digit V is supposedly absent in chrysochlorids (Puttick & Jarvis, 1977; Gasc et al., 1986).

M. extensor carpi ulnaris originates from the distal end of the lateral epicondyle, somewhat fused with the larger m. extensor digitorum lateralis. The muscle has a tiny delicate tendon, which inserts in an expansion over the rudimentary metacarpal IV. This tendon of insertion was damaged during skinning, but Jullien (1967) also noted this insertion for *Chrysochloris*. Again, different insertions are recorded in different genera: the unciform (hamate) in *Amblysomus* and *Chrysochloris* (Dobson, 1883; Puttick & Jarvis, 1977), metacarpal III in *Eremiptalpa* (Gasc et al., 1986), and the absent metacarpal V – presumably this refers to what is considered metacarpal IV – in *Chrysospalax* (Parsons, 1901).

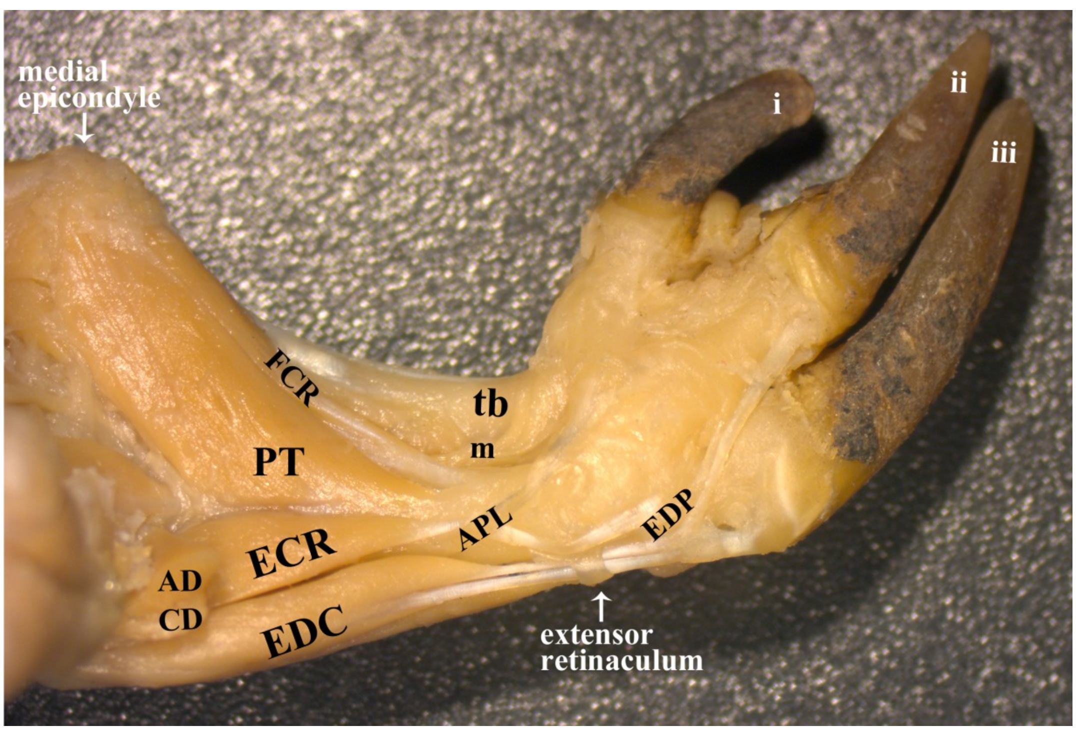
M. supinator is a tiny cylindrical muscle which originates from the cranial surface of the lateral epicondyle, deep to m. extensor carpi radialis. It inserts on the cranial surface of the radius at about midshaft. Only Dobson (1883) and Puttick & Jarvis (1977) describe this muscle in *Amblysomus* and *Chrysochloris*; it may be absent in some chrysochlorids.

M. extensor digitorum profundus originates for 3.5 mm from the proximal end of the lateral ulna. The flat muscle becomes a tendon which travels through the strong extensor retinaculum deep to the tendons of m. extensor digitorum communis. Remaining deep, it follows exactly the branching pattern of m. extensor digitorum communis tendons to digits II and III. Other authors only describe an insertion on digit II (Dobson, 1883; Jullien, 1967; Puttick & Jarvis, 1977; Gasc et al., 1986).

M. abductor pollicis longus originates for 3 mm from the proximal lateral ulna deep to m. extensor digitorum profundus. The flat muscle is closely applied to the bones of the forearm, then crosses superficial to m. extensor carpi radialis to insert on the bases of metacarpal I and II via several small slips of tendon. Only an attachment to metacarpal I is noted in other chrysochlorid genera (Dobson, 1883; Jullien, 1967; Puttick & Jarvis, 1977; Gasc et al., 1986).



A.



B.

Figure 3.2C-16. Muscles originating from the lateral epicondyle.
A. Lateral view. B. Cranial view.

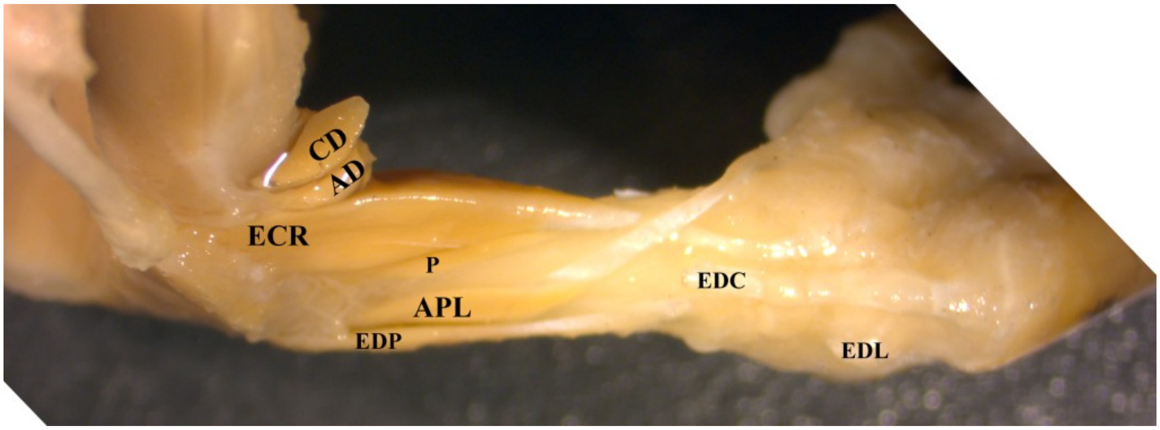


Figure 3.2C-17. Mm. extensor carpi radialis and abductor pollicis longus, cranial view (S-152649-0144).

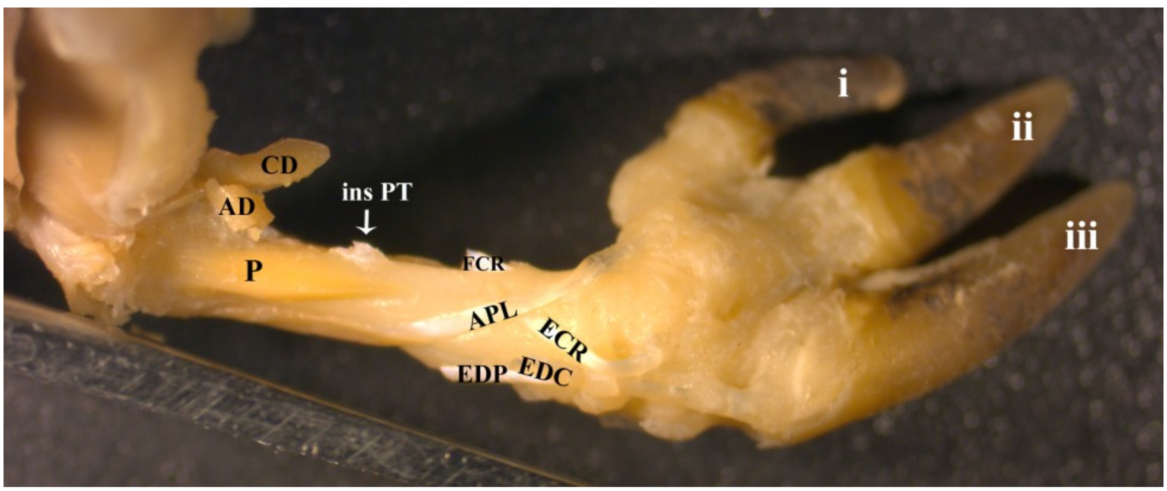


Figure 3.2C-18. M. supinator [P], cranial view.

L. FLEXOR GROUP – MEDIAN and ULNAR NERVES

mm. pronator teres[m], flexor carpi radialis[m], palmaris longus[u], flexor digitorum superficialis, flexor digitorum profundus, flexor carpi ulnaris[u], epitrochleo-anconeus[u], pronator quadratus

M. pronator teres is large and fleshy. It originates for 1.1 mm on the cranial surface of the medial epicondyle and inserts for 2 mm along the middle of the cranio-medial aspect of the radius, ending at a small tubercle.

M. flexor carpi radialis has a 0.5 mm origin from the cranial surface of the medial epicondyle, distal to the origin of m. pronator teres. After 3.5 mm it becomes a round tendon which travels into an osseous tunnel in the distal radius. It inserts on the palmar surface of the base of metacarpal II. Gasc et al. (1986) describes an insertion on the trapezium in *Eremiptalpa*.

M. flexor digitorum superficialis is absent, or perhaps the muscle identified below as mm. flexor digitorum breves manus (section M) is really m. flexor digitorum superficialis. Other authors have identified m. flexor digitorum superficialis in chrysochlorids, but this muscle seems to be m. palmaris longus and mm. flexor digitorum breves manus (Dobson, 1883; Jullien, 1967; Puttick & Jarvis, 1977; Gasc et al., 1986). An absent or vestigial m. flexor digitorum superficialis is also the condition in *Potamogale* and aardvark.

M. palmaris longus is a fleshy, triangular belly which takes origin from 1.4 mm along the caudal surface of the medial epicondyle. It becomes a flat band of tendon which ends at the flexor retinaculum and is attached to the widening of the so-called "third bone," a sesamoid within the tendon of m. flexor digitorum profundus, at the base of digit IV. A tiny nerve, the superficial branch of the ulnar nerve, emerges lateral to m. palmaris longus and travels medial to digit IV. M. palmaris longus is innervated by a branch of the ulnar nerve, which enters the proximal end of the muscle. As mentioned above, this muscle has previously been identified as m. flexor digitorum superficialis (Dobson, 1883; Jullien, 1967; Puttick & Jarvis, 1977; Gasc et al., 1986).

M. flexor digitorum profundus has three bellies of origin, two from the medial epicondyle and one from the ulna. The superficial epicondylar belly of m. flexor digitorum profundus has no muscle fibers; rather, it is a tendinous band originating from the caudal tip of the medial epicondyle. It very quickly joins with the deep epicondylar belly of m. flexor digitorum profundus originating from the caudal surface of the medial epicondyle via mixed fleshy and tendon fibers. The two epicondylar portions insert on the proximal end of the "third bone."

The ulnar portion of m. flexor digitorum profundus originates from the caudo-medial surface of the curved olecranon and continues along the entire medial ulna. The muscle is fleshy, and a central tendon appears about midshaft and joins the caudo-lateral edge of the "third bone." At the flexor retinaculum, the "third bone" ends and four tendons appear. A tiny tendon for digit IV perforates through the tendon of m. flexor breves manus. There is a huge doubled tendon to digit III, which continues straight on from the "third bone" and presumably can transmit the most force from the muscle. There is also a large tendon to digit II which lies deep to the median nerve. A smaller tendon goes to digit I. Some small vessels and a branch of the median nerve dive deep into the palm between the tendons of m. flexor digitorum profundus to digits II and III.

The “third bone” is 2.6 mm long and is a very large sesamoid bone in the center of the tendon of m. flexor digitorum profundus in the forearm. This structure has been described as the ossified tendon of m. flexor digitorum profundus, and its extent appears to vary in different golden mole species (Gasc et al., 1986). There is a large bursa deep to the “third bone” as it crosses the carpus, and some cartilaginous pads for it to glide over in the palm.

M. flexor carpi ulnaris has only an ulnar origin, as in *Potamogale* and *Orycteropus*, which originates from the medial side of the curved olecranon adjacent to the ulnar attachment of m. epitrochleo-anconeus. It is a thin and flat muscle. After 4.5 mm it becomes a flat tendon which rounds into a stout cylinder before inserting on the pisiform.

M. epitrochleo-anconeus is a 2.3 mm long fleshy belly spanning between the tip of the medially curving olecranon and the tip of the medial epicondyle deep to the insertion of m. dorso-epitrochlearis. The muscle is also connected to the caudal surface of the humerus distal to the entepicondylar foramen.

M. pronator quadratus is absent in *Calcochloris*, or is represented by a few vestigial white fibers found between the proximal radius and ulna.

The median nerve travels through the entepicondylar foramen and emerges in the forearm deep to m. pronator teres. It surfaces on the ulnar side of m. flexor carpi radialis, and hooks around the base of digit I deep to the flexor retinaculum to enter the manus. The most proximal branch travels along the radial side of digit I. The next branch travels between mm. flexor digitorum breves manus tendons to digits I and II, followed by a branch to the ulnar side of digit I, the branch diving deep into the palm between m. flexor digitorum profundus tendons to digits II and III. The largest branch travels between digits II and III and splits to provide sensory innervation to those digits.

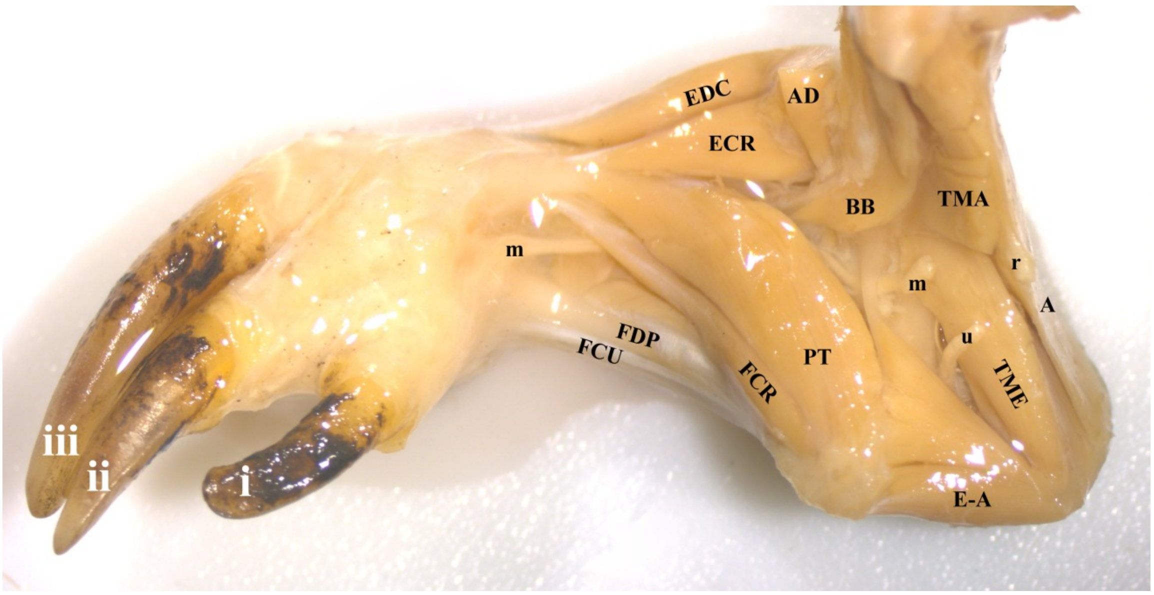


Figure 3.2C-19. Muscles originating from the medial epicondyle, medial view.

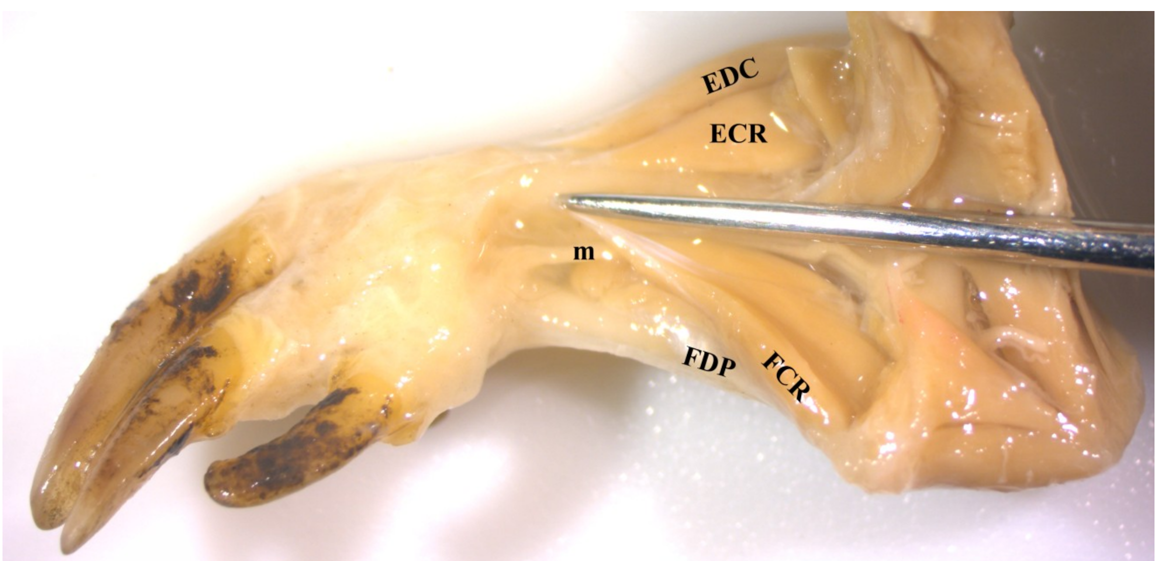


Figure 3.2C-20. M. flexor carpi radialis entering osseous tunnel, medial view.

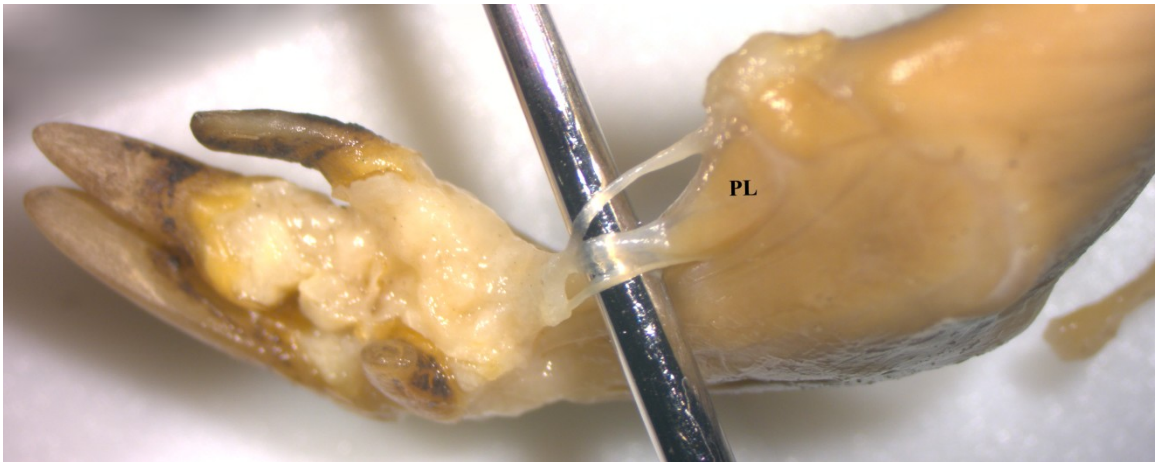


Figure 3.2C-21. M. palmaris longus, caudal view.

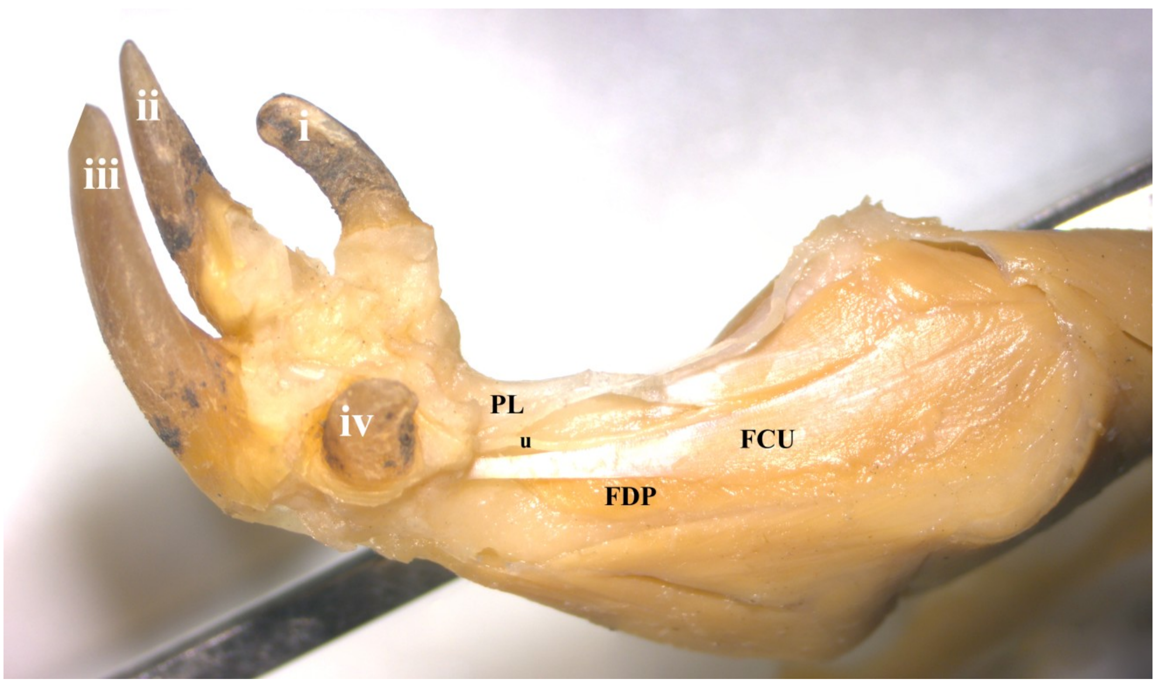


Figure 3.2C-22. M. flexor carpi ulnaris, caudal view.

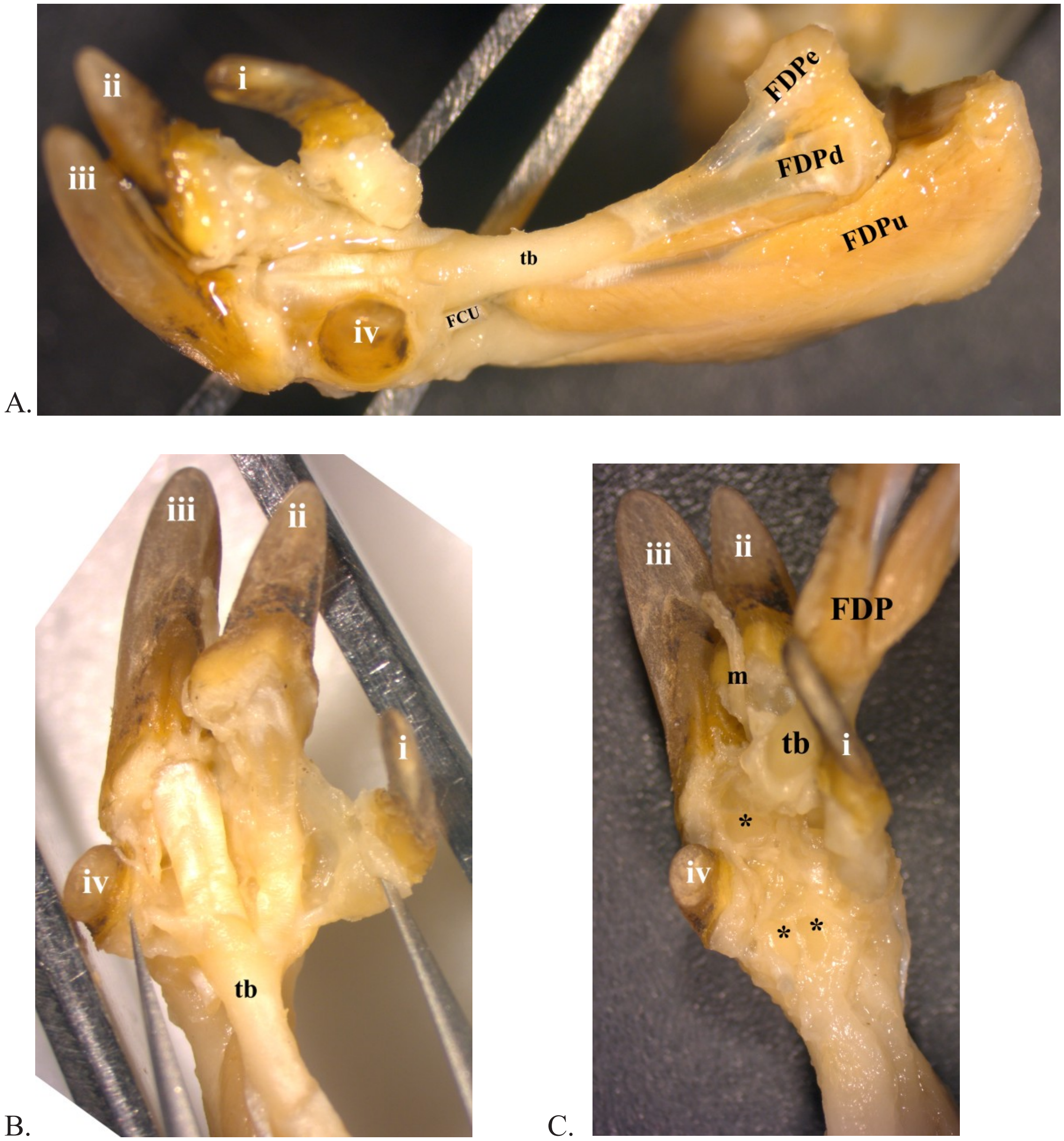


Figure 3.2C-23. M. flexor digitorum profundus and “third bone.”

A. Caudal view. B. Tendons of m. flexor digitorum profundus in situ. C. Tendons of m. flexor digitorum profundus r eflected to show cartilaginous pads in palm (S-145654-0116).

[FDP – m. flexor digitorum profundus, * – cartilaginous pads, tb – “third bone”]

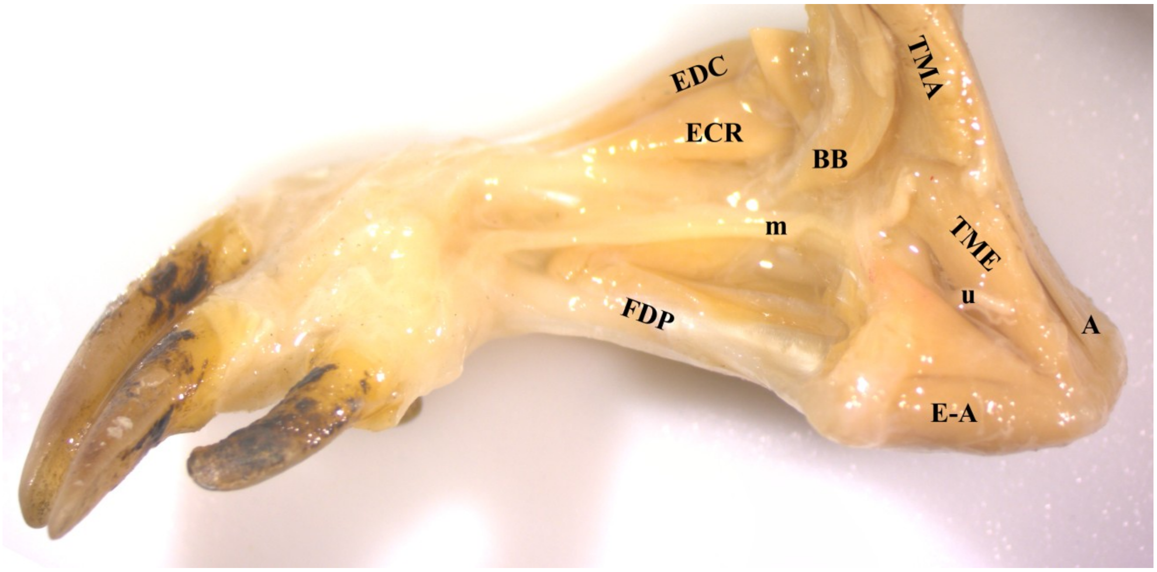


Figure 3.2C-24. Median nerve in forearm.

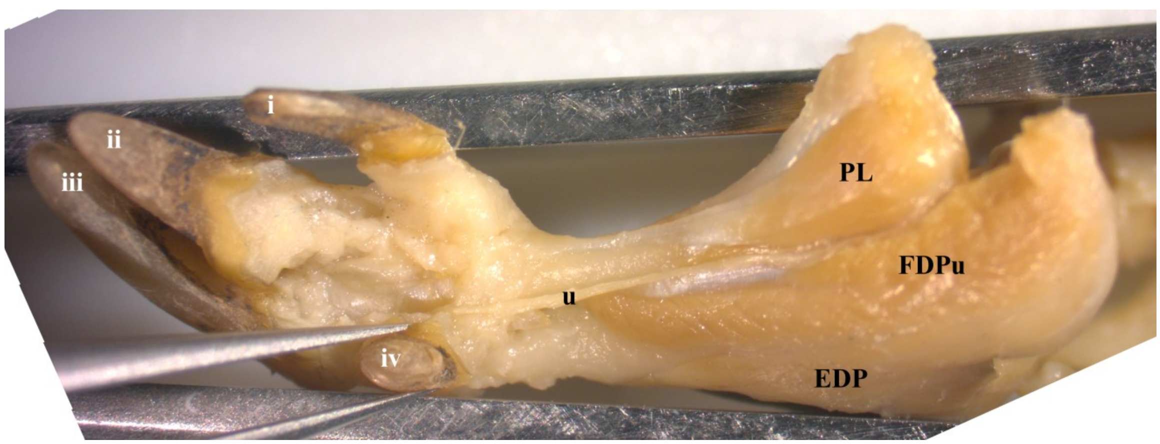


Figure 3.2C-25. Ulnar nerve in forearm.

M. MANUS GROUP – MEDIAN and ULNAR NERVES

mm. flexor digitorum breves manus[m], abductor digiti minimi, contrahentes

I am not convinced that the digits are identified correctly in golden moles. The four fingers are supposedly the radial digits (I-IV) while the fifth digit "fails to develop in the early stages of the ontogenetic process" (Gasc, et al., 1986: 17). Despite misgivings, I refer to and label the digits of *Calcochloris* as digits I-IV, following published standards used for other species of chyrsochlorid (Puttick & Jarvis, 1977; Gasc et al., 1986).

There is an abundance of white tendinous tissue in the palm, so it is difficult to identify what remnants of muscles are present. However, based on positional relationships to the median and ulnar nerves and the flexor tendons, three different vestigial muscles can be tentatively identified. All other muscles of the manus are absent.

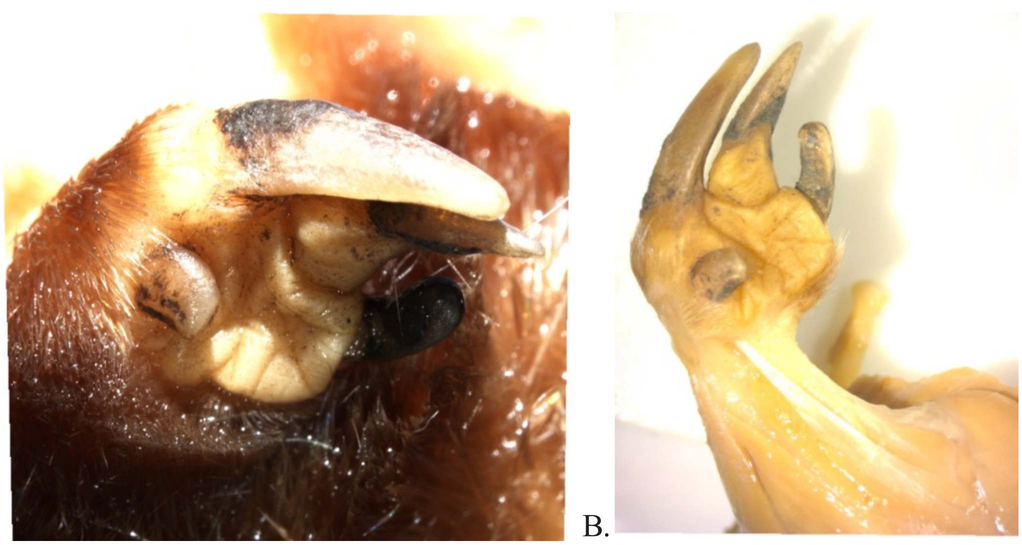
Mm. flexor digitorum breves manus has no visible muscle fibers; however, it is clearly present serving digit II and possibly also digits I and IV. There is a tiny cylinder of white tendon that originates from the flexor retinaculum and inserts on the flexor tendon of digit II; this tendon receives a branch of the median nerve. This tendon perhaps sends a very small tendon to the distal end of metacarpal I, but this is really difficult to verify. There is also a small flat tendon at the lateral side of the base of digit IV, but I was unable to determine the innervation of this structure. This tendon for digit IV might be part of mm. flexor digitorum breves manus, although it has been called an “oblique ligament” (Gasc et al., 1986).

Mm. palmaris longus and flexor digitorum breves manus have been confounded as m. flexor digitorum superficialis in other anatomical descriptions of chrysochlorids.

This is because the tendon of m. palmaris longus ends at the flexor retinaculum, and mm. flexor digitorum breves manus originates there. Thus, the muscles appear to be continuous and have been identified as m. flexor digitorum superficialis (Dobson, 1883; Jullien, 1967; Puttick & Jarvis, 1977). However, m. flexor digitorum superficialis originates from the surface of m. flexor digitorum profundus or the medial epicondyle in other afrotheres, not the flexor retinaculum, and so I have determined it is absent in *Calcochloris*. Also, in this specimen, m. palmaris longus is ulnar nerve innervated whereas mm. flexor digitorum breves manus is median nerve innervated.

M. abductor digiti minimi is a short fibrous tendon stretching from the lateral carpus to the base of the reduced digit IV (in the absence of digit V).

The only muscle fibers in the manus, a tiny fleshy slip stretching between digits II and IV, is presumably the remnants of m. contrahens. This extremely tiny muscle could possibly adduct both digits II and IV upon contraction, or flex digit IV. A vestigial m. contrahens between digits I-II was described for *Eremitalpa* (Gasc et al., 1986).



A. B.

Figure 3.2C-26. Right manus pre-dissection. A. Prior to skinning. B. After skinning.

Figure 3.2C-27. Flexor retinaculum superficial to probe, caudal view.

Note origin of mm. flexor digitorum breves manus.

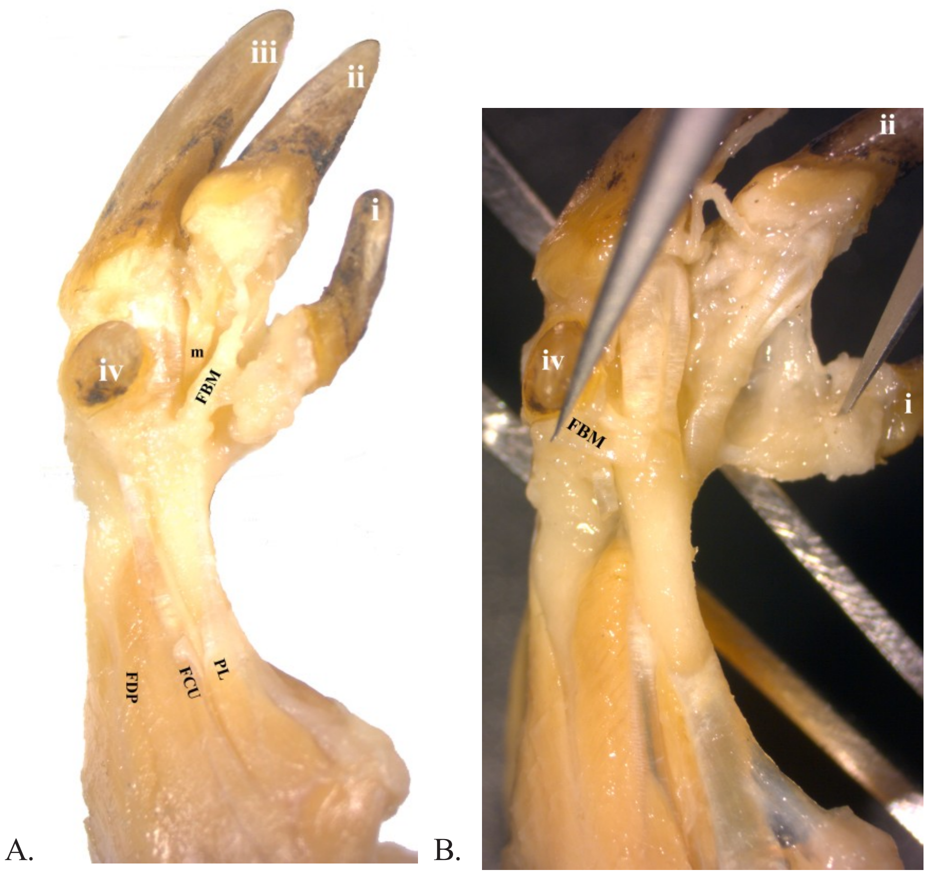


Figure 3.2C-28. Mm. flexor digitorum breves manus.

A. Inserting on digit II and possibly digit I. B. Possible m. flexor digitorum breves manus for digit IV, visible after flexor retinaculum is removed (S-144653-0109).

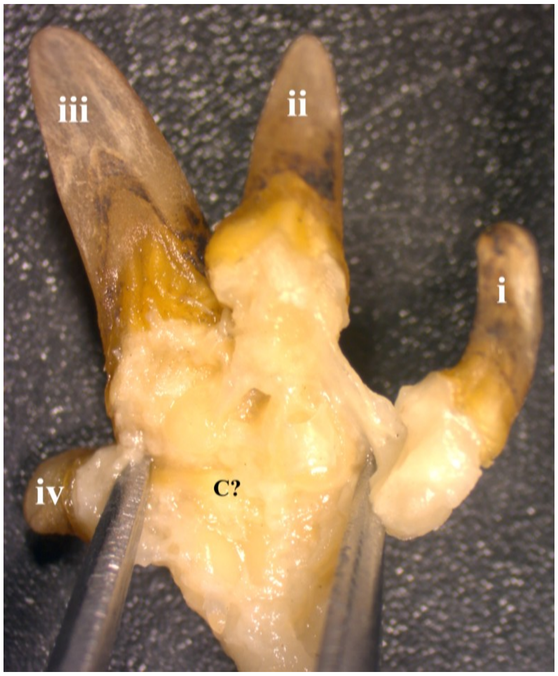


Figure 3.2C-29. Possible m. contrahens (S-151801-0137).

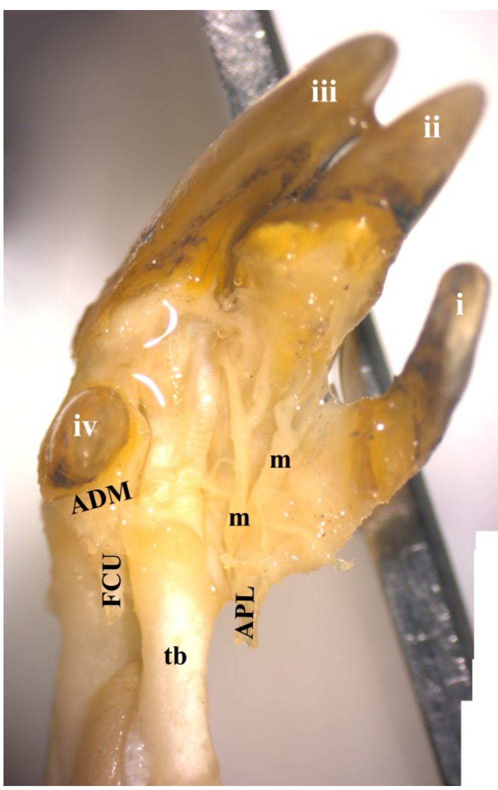
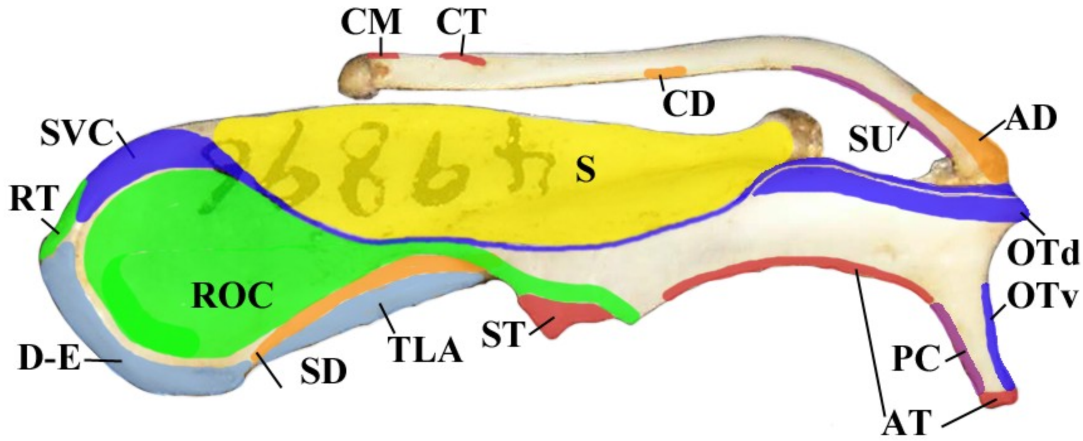
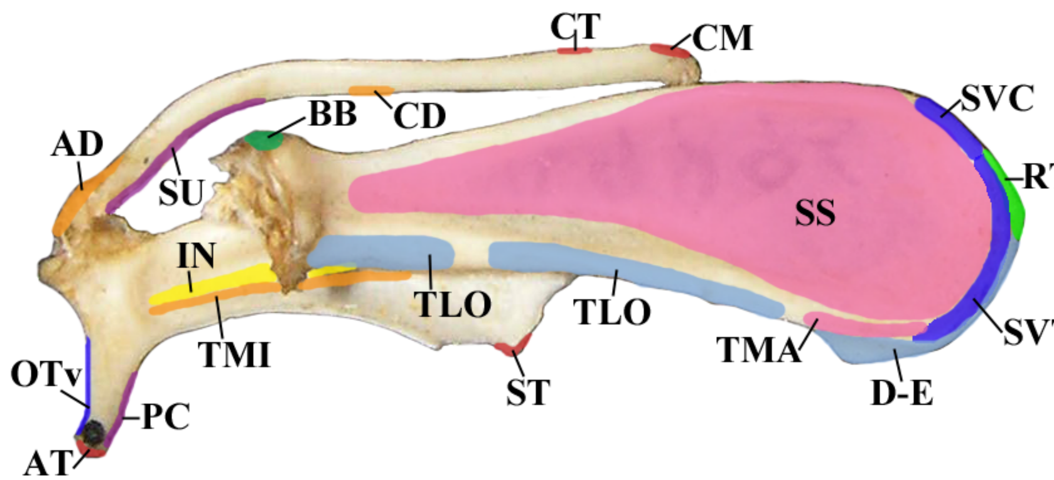


Figure 3.2C-30. M. abductor digiti minimi and median nerve in palm.



A.



B.

Figure 3.2C-31. Muscle attachment maps for the scapula.

A. Superficial surface of scapula. B. Deep surface of scapula.

[AD- acromiodeltoideus, AT- acromiotrapezius, BB- biceps brachii, CB- coracobrachialis, D-E- dorso-epitrochlearis, IN- infraspinatus, OT – omotransversarius, S- supraspinatus, S-S- sternoscapularis, SS – subscapularis, SV- serratus ventralis, SVC- serratus ventralis cervicis, RCT- rhomboideus cervicis et thoracis, RO- rhomboideus capitis, TLO- triceps brachii caput longum, TMI – teres minor]

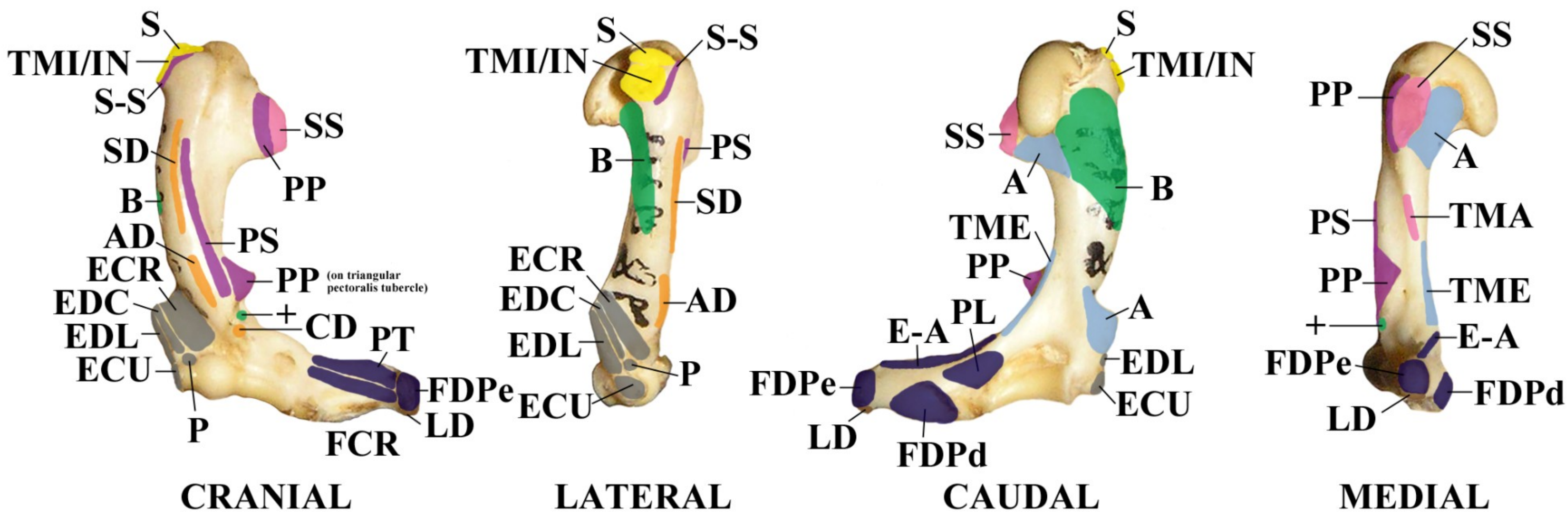


Figure 3.2C-32. Muscle attachment maps for the humerus.

[+- cubitalis, A- anconeus, AD- acromiodeltoideus, B- brachialis, E-A- epitrochleo-anconeus, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, FCR- flexor carpi radialis, FDPe- superficial portion of flexor digitorum profundus, FDPd- deep portion of flexor digitorum profundus, LD- latissimus dorsi, PL- palmaris longus, PP- pectoralis profundus (on triangular tubercle), PS- pectoralis superficialis, PT- pronator teres, S- supraspinatus, S-S- sternoscapularis, SD- spinodeltoideus, SS- subscapularis, TLA- triceps brachii caput laterale, TMA- teres major, TME- triceps brachii caput mediale, TMI/IN- teres minor and infraspinatus]

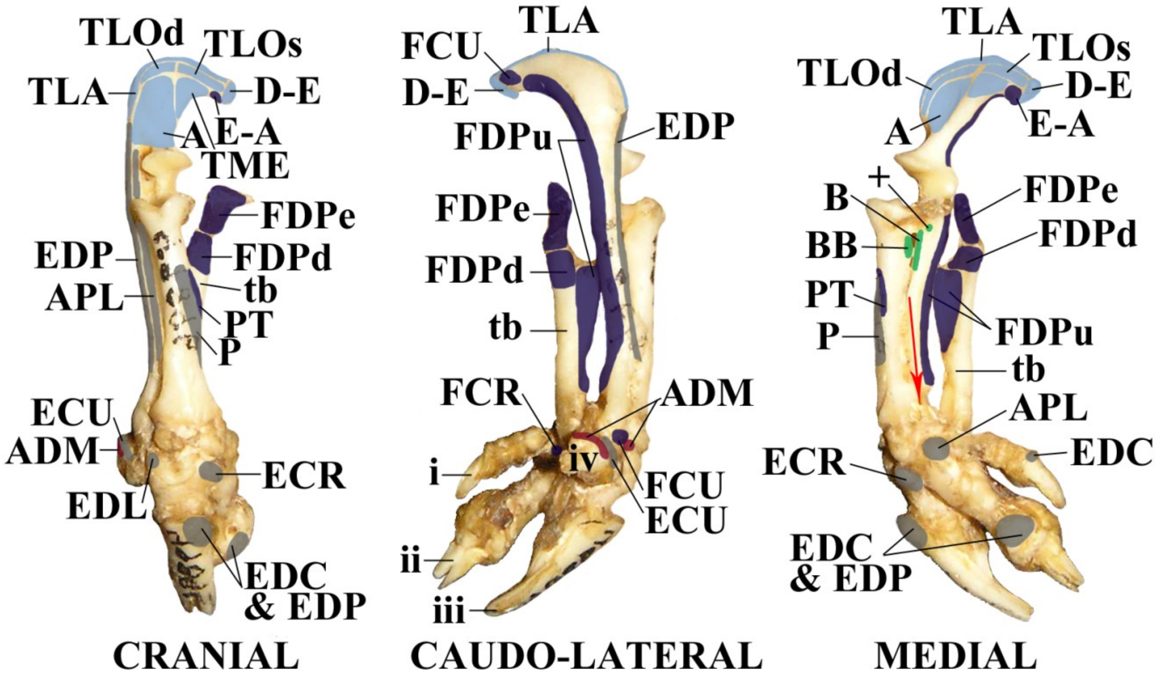


Figure 3.2C-33. Muscle attachment maps for the radius, ulna, and manus.

In medial view, red arrow points to osseous tunnel for tendon of m. flexor carpi radialis.

[+- cubitalis, A – anconeus, ADM – abductor digiti minimi, APL – abductor pollicis longus, B – brachialis, BB – biceps brachii, D-E – dorso-epitrochlearis, E-A – epitrochleo-anconeus, EDL – extensor digitorum lateralis, EDP – extensor digitorum profundus, FCR – flexor carpi radialis, FCU – flexor carpi ulnaris, FDPd – deep epicondylar head of flexor digitorum profundus, FDPe – superficial epicondylar head of flexor digitorum profundus, FDPu – ulnar head of flexor digitorum profundus, i – digit I, ii – digit II, iii – digit III, iv – digit IV, P – supinator, PT – pronator teres, TLA – triceps brachii caput laterale, TLOd – triceps brachii caput longum profundus, TLOs – triceps brachii caput longum superficialis TME – triceps brachii caput mediale]

3.3A – Macroscelidea – Macroscelididae – *Elephantulus brachyrhynchus*

The forelimb myology of macroscelidids is not well studied. *Elephantulus* was discussed by Jullien (1967), and Haines (1955) reconstructed the manus of *Elephantulus myurus* from cross-section. Provided here is a description of the extrinsic and intrinsic muscles of the forelimb of a specimen of *Elephantulus brachyrhynchus*, the Short-snouted Elephant Shrew (Macroscelidea: Macroscelididae) collected for the American Museum of Natural History in Angola in 1925. The pollux is small on both forefeet. Due to the small size of the specimen it was dissected under a microscope.

A.


B.

Figure 3.3A-1. Pre-dissection photographs of *Elephantulus brachyrhynchus*, AMNH 87026.

A. Lateral view right side. B. Ventral view.

0. CUTANEOUS MUSCULATURE

mm. cutaneous ventralis, sphincter colli, panniculus carnosus, dorsocutaneous

M. cutaneous ventralis is made of up of thin fibers with no bony insertion.

M. sphincter colli is 1.5 mm wide. It originates from the occipital midline and ends in the ventral neck superior to the manubrium.

M. panniculus carnosus is connected into the caudal edge of mm. pectoralis and the fascia over mm. biceps brachii and brachialis.

M. dorsocutaneous is absent, but see the description of “intermediate trapezius.” It is possible m. dorsocutaneous has achieved a bony insertion and is identified here as “intermediate trapezius.”

Figure 3.3A-2. Cutaneous musculature, lateral view.

A. TRAPEZIUS GROUP – ACCESSORY NERVE and CERVICAL NERVES

mm. sternomastoideus, cleidomastoideus, clavotrapezius, acromiotrapezius, "intermediate trapezius," spinotrapezius

M. sternomastoideus originates with m. cleidomastoideus from the mastoid process, and is the more ventral of the pair. The muscle is 2 mm wide and extends for 1 cm before it inserts on the surface of the manubrium. Proximally it is deep to the submandibular gland, and it travels medial to the common carotid artery in the neck.

M. cleidomastoideus originates deep (dorsal) to m. sternomastoideus from the mastoid process. The muscle is 1.5 mm wide and spans 1 cm before it inserts on the cranial edge of the medial end of the clavicle. This differs from the insertion in *Petrodromus*, which is on the manubrium.

M. clavotrapezius is an extremely tiny 1 mm wide ribbon of muscle originating from the occipital crest. It is separated from m. acromiotrapezius by the great auricular nerve. It crosses over the distal end of m. omotransversarius and inserts on the cranial edge of the middle clavicle.

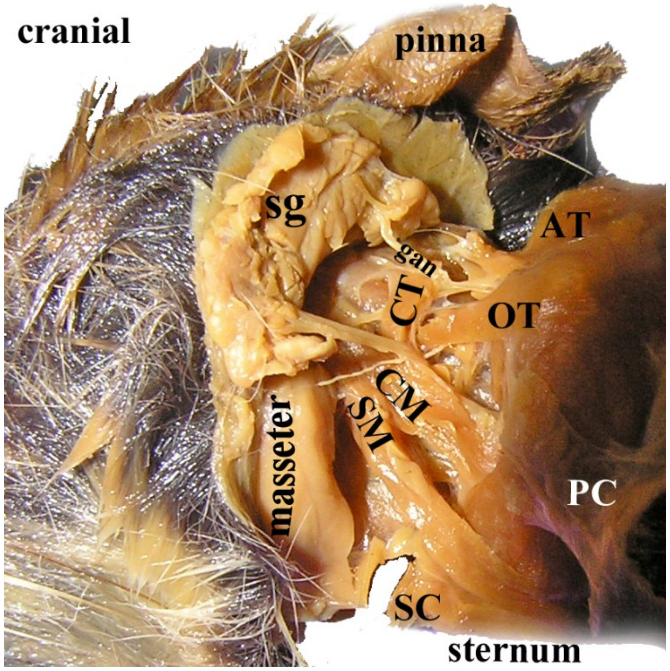
M. acromiotrapezius originates from the ligamentum nuchae and proximal thoracic spinous processes. The muscle is 8 mm wide at its origin but promptly divides into two sections. The cranial portion of m. acromiotrapezius inserts via fleshy fibers onto the caudal half of the metacromion just dorsal to the insertion of m. omotransversarius. The more caudal portion of m. acromiotrapezius inserts in two parts: via a thin 1 mm wide slip onto the caudal half of the metacromion just dorsal to the insertion of the other portion, and as a thin sheet onto the middle 50% of the scapular spine.

The unusual m. intermediate trapezius is a thick, fleshy muscle which originates from the spinous processes of three thoracic vertebrae, superficial to m. rhomboideus thoracis. It is 2 mm wide and spans 4 mm from the vertebral column to the scapula. It inserts via tendinous fibers medial to the insertion of m. spinotrapezius on the vertebral border of the scapula near the base of the scapular spine.

M. spinotrapezius is superficial to latissimus dorsi. At its origin from the first lumbar vertebra, m. spinotrapezius is tapered to a point and also has a fascial connection with the gluteal muscles. Throughout its 2.5 cm length the muscle is 2 mm wide. It inserts via fleshy fibers on the caudal edge of the posterior third of the scapular spine, immediately caudal to the insertion of mm. deltoideus. It overlaps with the insertion of the caudal portion of m. acromiotrapezius, which is on the cranial edge of the scapular spine. M. spinotrapezius of *Elephantulus* has more bony connection and less insertion onto muscle than m. spinotrapezius of *Petrodromus*.

In the specimen dissected there was a significant amount of brown fat in the midline between the scapulae which is continuous with fat deep to mm. acromiotrapezius, spinotrapezius, and rhomboideus.

A.



B.

C.

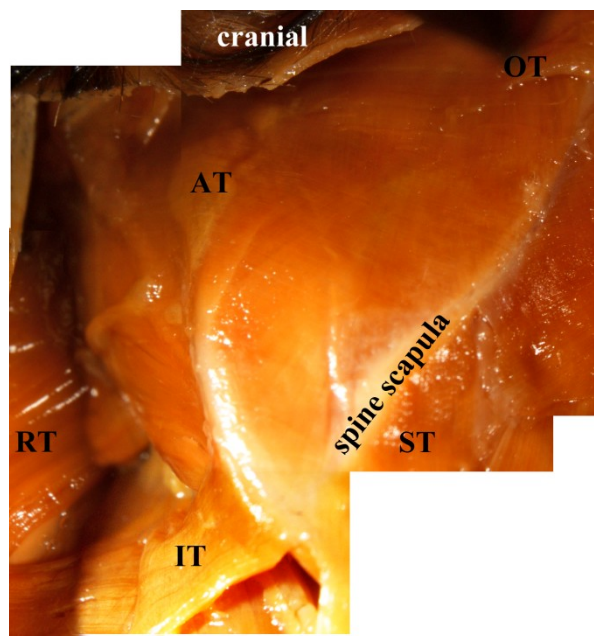
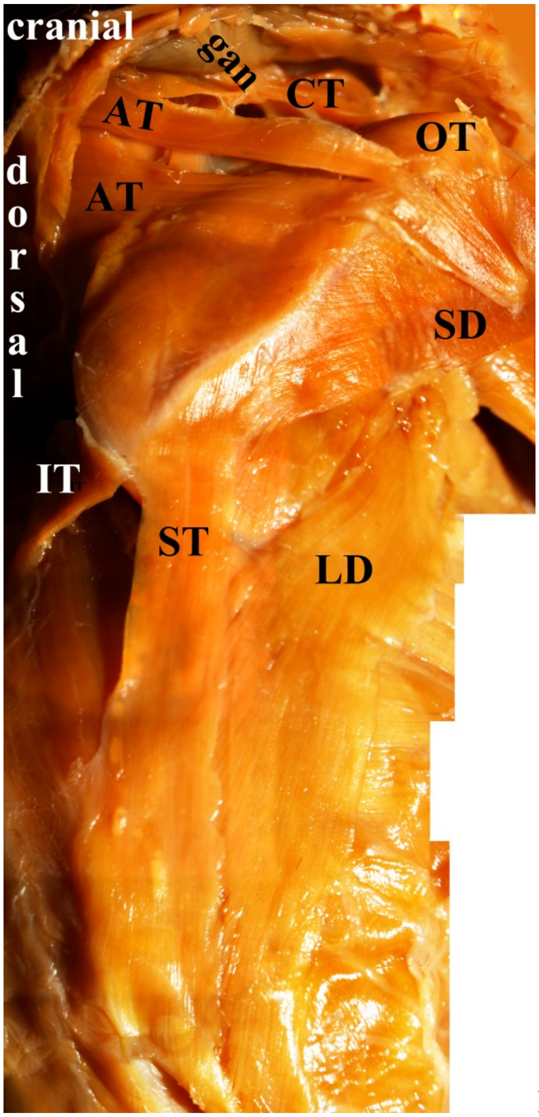


Figure 3.3A-3. Trapezius complex.

A. Lateral view, left side (P2142498). B. “M. intermediate trapezius” deep to fat pad, dorsal view right side. C. “M. intermediate trapezius” inserting on the vertebral border of the scapula, dorsal view right side.

D. 

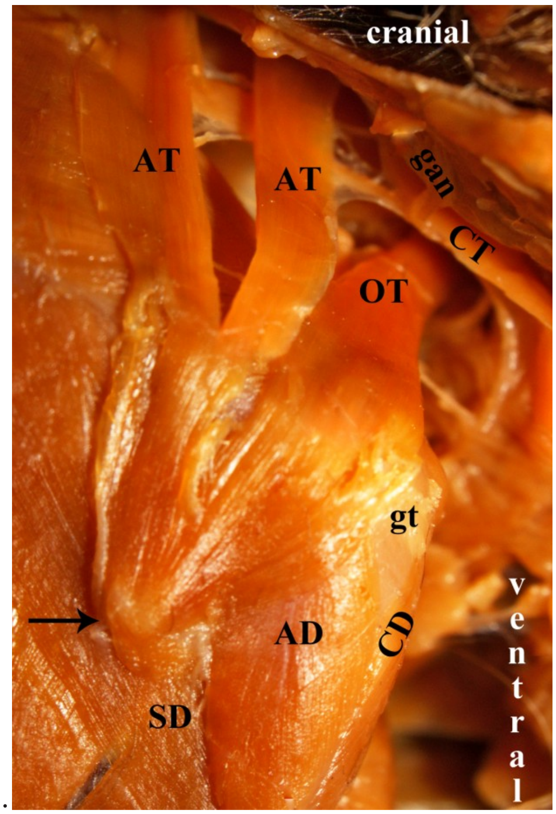
E. 

Figure 3.3A-3 continued. Trapezius complex. D. Dorsal view, right side. E. Lateral view of right shoulder showing insertions on tip of metacromion process (black arrow).

[AD- acromiodeltoideus, CD- clavodeltoideus, AT- acromiotrapezius, CM- cleidomastoideus, CT- clavotrapezius, gan- great auricular nerve, gt- greater tuberosity, IT- intermediate trapezius, OT- omotransversarius, PC- panniculus carnosus, RT- rhomboideus thoracis, SC- sphincter colli, sg- salivary gland, SM- sternomastoideus, SD- spinodeltoidues, ST- spinotrapezius]

B. RHOMBOID GROUP – DORSAL SCAPULAR NERVE

mm. rhomboideus capitis, rhomboideus cervicis, rhomboideus thoracis

M. rhomboideus capitis is a thin and delicate muscle with a 1 mm-wide origin from the occiput. It expands to 4 mm wide before its tendinous insertion along the deep surface of the vertebral border of the scapula, between the insertions of mm. serratus ventralis cervicis et thoracis and rhomboideus cervicis.

M. rhomboideus cervicis has a 1 cm origin along the spinous processes of the last cervical and first thoracic vertebrae. It inserts via two fleshy digitations which total 5 mm wide along the deep surface of the vertebral border of the scapula, between the insertions of mm. rhomboideus capitis and rhomboideus thoracis. It also inserts along the dorsal surface of the vertebral border of the scapula. There it is flanked cranially and caudally by the insertion of m. serratus ventralis cervicis et thoracis, and is deep to the insertion of "m. trapezius intermediate," and superficial to the insertion of m. rhomboideus thoracis.

M. rhomboideus thoracis originates from the spinous processes of a few thoracic vertebrae spanning 2 mm. It inserts near the caudal angle of the scapula, deep to the insertion of m. rhomboideus cervicis.

C. OMO GROUP – CERVICAL NERVES, LONG THORACIC NERVE

mm. omotransversarius, omohyoideus, serratus ventralis (cervicis, thoracis)

M. omotransversarius originates from the transverse process of the atlas. It is 3 mm wide and is the same thickness as the cranial portion of m. acromiotrapezius and m. clavotrapezius. It inserts via fleshy fibers on the tip of the metacromion.

M. omohyoideus is absent.

M. serratus ventralis cervicis has a 5 mm wide origin via two digitations from the transverse processes of the cervical vertebrae. M. serratus ventralis thoracis originates via four distinct digitations from the ribs and is 9 mm wide. The two portions have indistinct muscle fibers appearing in the fascia between them before they merge. The combined muscle inserts in a wide band along the deep surface of the vertebral border of the scapula, between the insertions of mm. rhomboideus and subscapularis. It also reaches the cranial and caudal angles of the scapula.

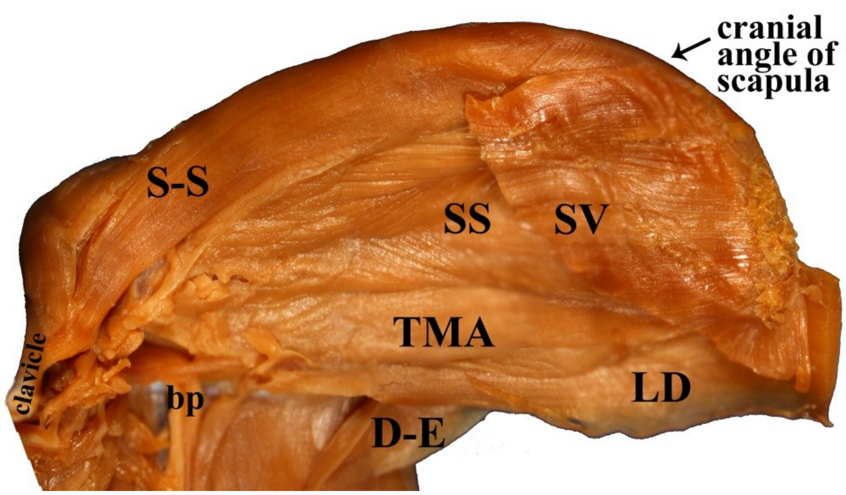


Figure 3.3A-4. Insertion of mm. serratus ventralis on deep surface of scapula.
[bp- brachial plexus, D-E- dorso-epitrochlearis, SS- subscapularis, S-S- sternoscapularis, SV- serratus ventralis, TMA- teres major]

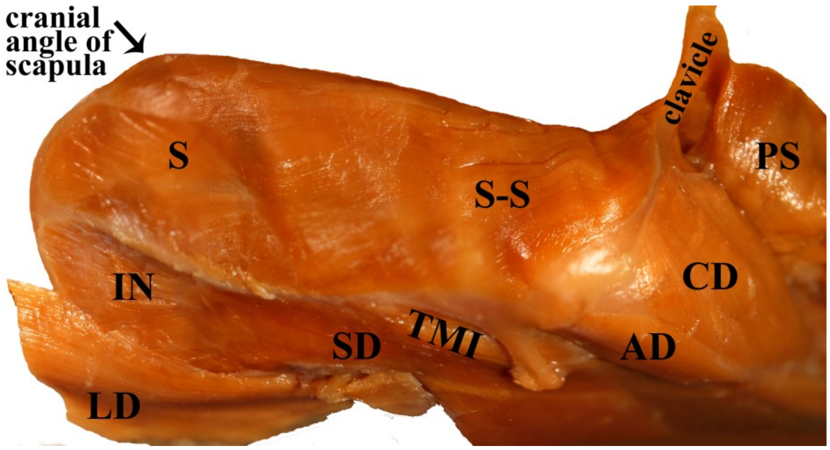
D. DELTOID GROUP – AXILLARY NERVE
mm. clavodeltoideus, acromiodeltoideus, spinodeltoideus, teres minor

M. clavodeltoideus originates on the caudal surface of the lateral half of the clavicle, where it has a connection with m. clavotrapezius. It forms a cap on the cranial aspect of the shoulder between mm. biceps brachii and brachialis. M. clavodeltoideus is thicker than m. acromiodeltoideus and joins the medial side of its insertion. The insertion extends along two-thirds of the humeral shaft, gradually sweeping from the deltopectoral crest to the cranial surface of the humerus.

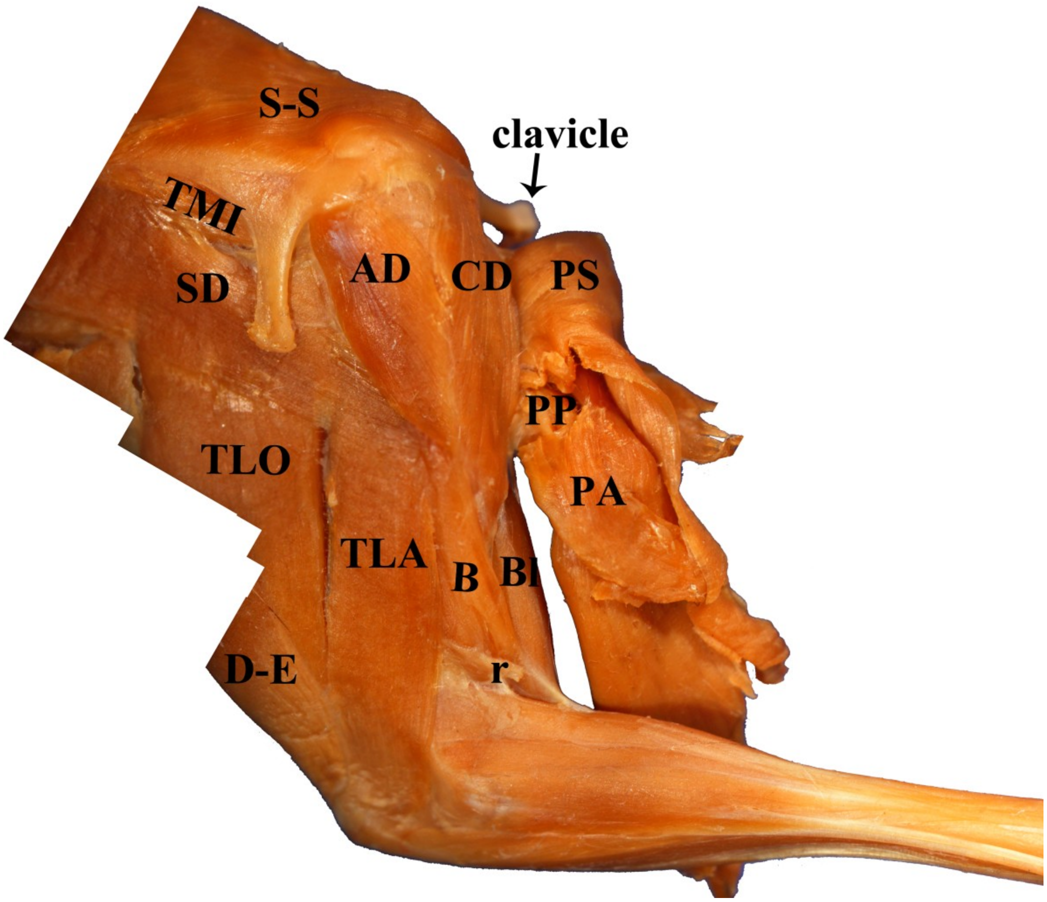
M. acromiodeltoideus originates for 3 mm along the acromion up to the junction with the metacromion. It is 6 mm long and fuses with m. clavodeltoideus around its midpoint. The muscle inserts on the proximal third of the humeral shaft, on the deltopectoral crest, between mm. spinodeltoideus and clavodeltoideus. The insertion of m. acromiodeltoideus is also fused with m. spinodeltoideus distally, but the proximal portions of their insertions are separate.

M. spinodeltoideus is 1.5 mm wide. Its mixed fleshy and tendinous origin extends 12 mm along the caudal surface of the spine of the scapula, partly covering the origins of mm. triceps brachii caput longum and teres minor. It is deep and lateral to m. acromiodeltoideus, and then joins it to insert for 2.5 mm along the deltopectoral crest.

M. teres minor has an entirely aponeurotic origin, as a long thin sheet from the entire caudal border of the scapula. At the level of the metacromion, a tiny muscle belly appears within this sheet. It inserts as a small, mixed fleshy and tendinous bundle just distal and lateral to the insertion of m. infraspinatus on the greater tuberosity of the humerus.



A.



B.

Figure 3.3A-5. Mm. deltoideus and teres minor.

A. Cranial view. B. Lateral view.
[AD- acromiodeltoideus, B- brachialis, Bl- biceps brachii long head, CD- clavodeltoideus, D-E- dorso-epitrochlearis, IN- infraspinatus, LD- latissimus dorsi, PA- pectoralis abdominalis, PP- pectoralis profundus, PS- pectoralis superficialis, r- radial nerve, S- supraspinatus, SD- spinodeltoideus, S-S- sternoscapularis, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, TMI- teres minor]

E. SUBSCAPULAR GROUP – SUBSCAPULAR NERVE

mm. subscapularis, teres major

M. subscapularis is comprised of two inter-connected bundles of fibers which converge to a 2 mm wide tendon which inserts into the fossa on the lesser tuberosity of the humerus. The muscle is also slightly attached to the gleno-humeral joint capsule. The clavicle obscures the insertion when the specimen is in anatomical position.

M. teres major is a thick, fleshy muscle which originates off the caudal angle of the scapula and from 8 mm along the thickened caudal edge of the scapula. In lateral view, the cranial half of the muscle is covered by the aponeurotic sheet of origin of m. teres minor, while the distal half of the muscle is visible except where it is crossed by mm. triceps brachii. It is joined by m. latissimus dorsi on its caudal edge, and their combined tendon inserts on the medial surface of the proximal humerus.

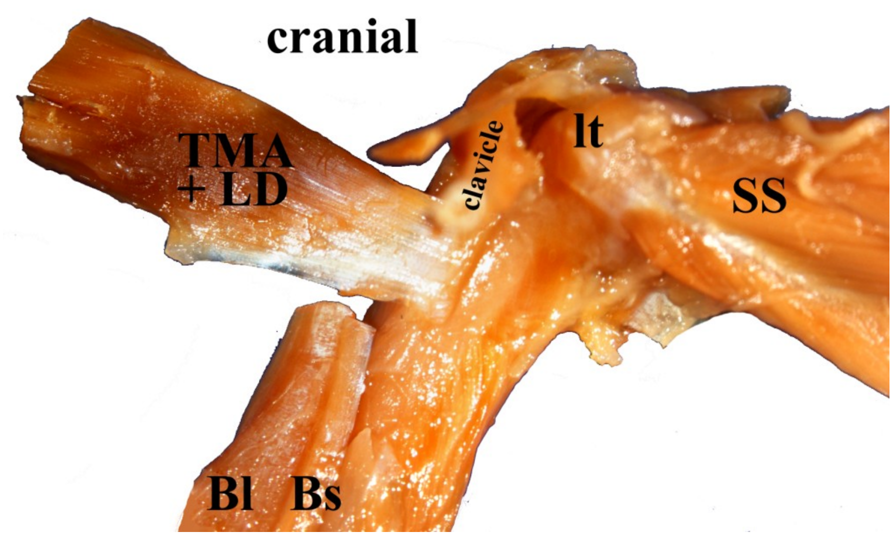


Figure 3.3A-6. Mm. teres major and latissimus dorsi inserting on humerus, medial view. [Bl- biceps brachii long head, Bs- Biceps brachii short head, LD- latissimus dorsi, lt- lesser tuberosity, SS- subscapularis, TMA- teres major]

F. LATISSIMUS GROUP – THORACODORSAL NERVE

m. latissimus dorsi

M. latissimus dorsi originates from the thoracic and lumbar vertebrae and the thoracolumbar fascia. The muscle is very thin and 1.5 cm long along the dorsum of the animal, but thickens and narrows to 5 mm wide before m. dorso-epitrochlearis takes origin from the muscle. Latissimus dorsi tapers to a small point, and its tendinous fibers join with the caudal edge of m. teres major. The joined muscles travel deep to the brachial plexus and, as a shiny tendon, have a 2 mm wide insertion onto the medial humerus just below the greater tuberosity.

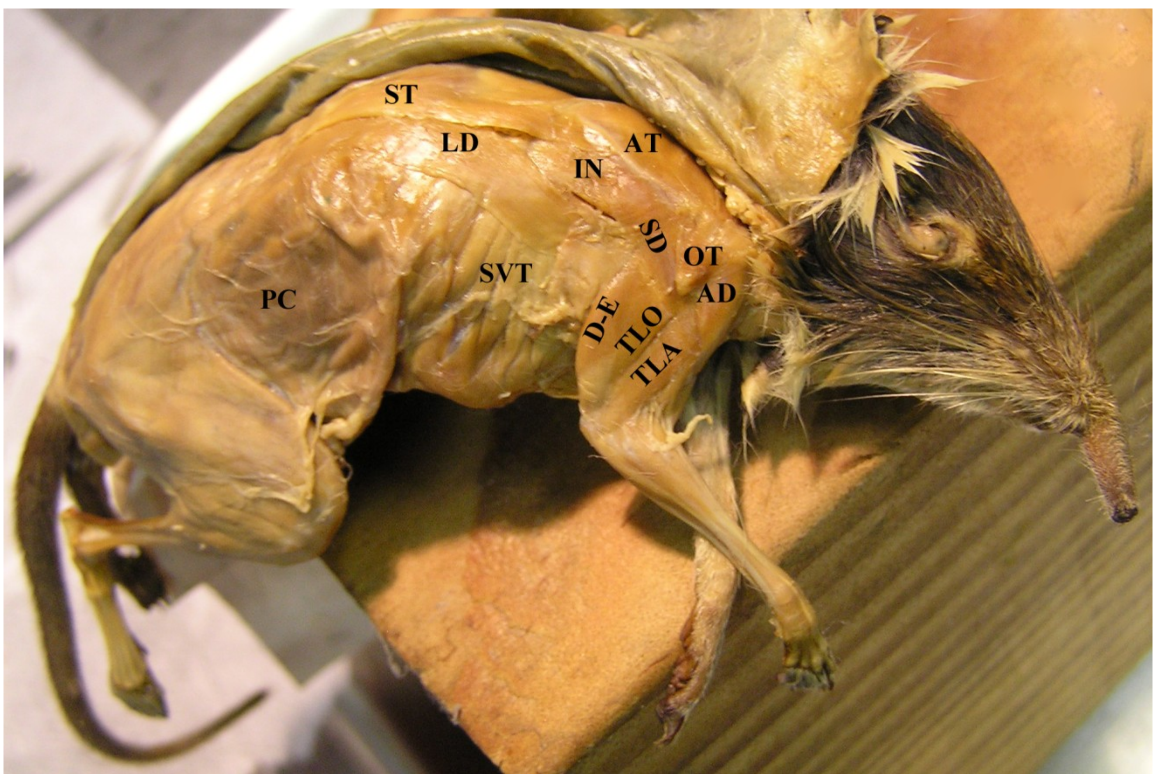


Figure 3.3A-7. M. latissimus dorsi, lateral view (P7310119).

G. PECTORALS GROUP – PECTORAL NERVES

mm. pectoralis superficialis, pectoralis profundus, pectoralis abdominalis, subclavius, sternoscapularis (=cleidoscapularis)

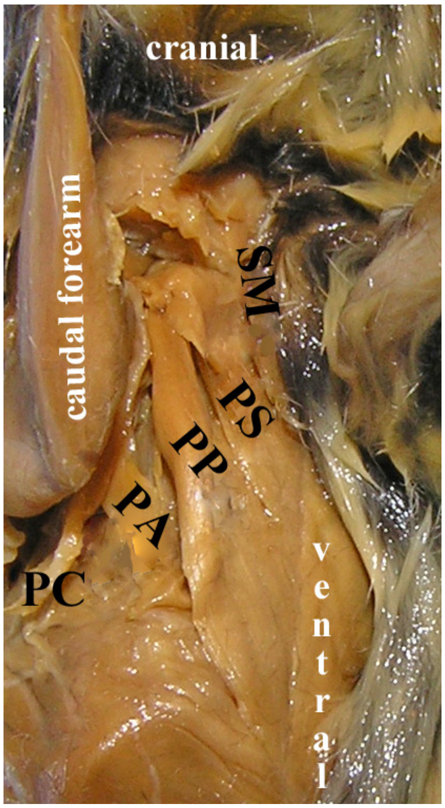
M. pectoralis superficialis has a 1 cm origin along the sternum. The muscle is 1 mm thick at its proximal end and its fibers course horizontally from the sternum to the deltopectoral crest. Distally, it is much thinner and the muscle fibers course sharply craniad before becoming horizontal. Its insertion is 3 mm long onto the deltopectoral crest, via mixed fleshy and tendinous fibers.

M. pectoralis profundus originates for 8 mm along the sternum, caudal to the origin of m. pectoralis superficialis. It is thicker than m. pectoralis superficialis. The insertion is 3 mm long on the medial edge of the distal greater tuberosity.

M. pectoralis abdominalis originates on the thorax caudo-lateral to m. pectoralis profundus. It is 2 cm long and inserts on the cranial humerus, just distal to the insertion of m. pectoralis profundus.

M. subclavius is 1.5 mm wide where it originates from the first costal cartilage. It inserts on the lateral third of the deep surface of the clavicle, lateral to the origins of mm. sternoscapularis and clavodeltoideus.

M. sternoscapularis (=cleidoscapularis) originates from the cranial and deep surfaces of the lateral two-thirds of the clavicle. The muscle is completely separable from m. subclavius. M. sternoscapularis covers the entire cranial edge of the scapula, with a 7 mm insertion along the acromion and scapular spine before sweeping craniodorsally over the cranial edge of m. supraspinatus. M. sternoscapularis also originates from the clavicle in *Petrodromus*, but in *Rhynchocyon* it originates from the sternum.

A. 

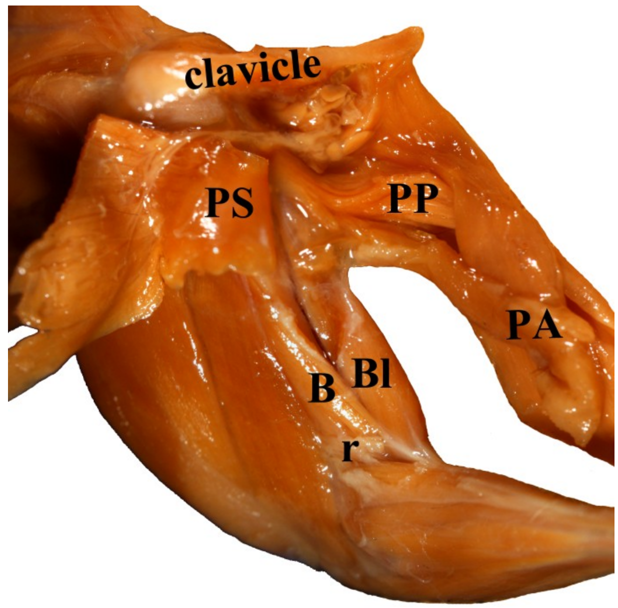
B. 

Figure 3.3A-8. Mm. pectoralis.

A. Ventral view (P8050011). B. Insertions on the cranial surface of the humerus.

H. BICEPS GROUP – MUSCULOCUTANEOUS NERVE

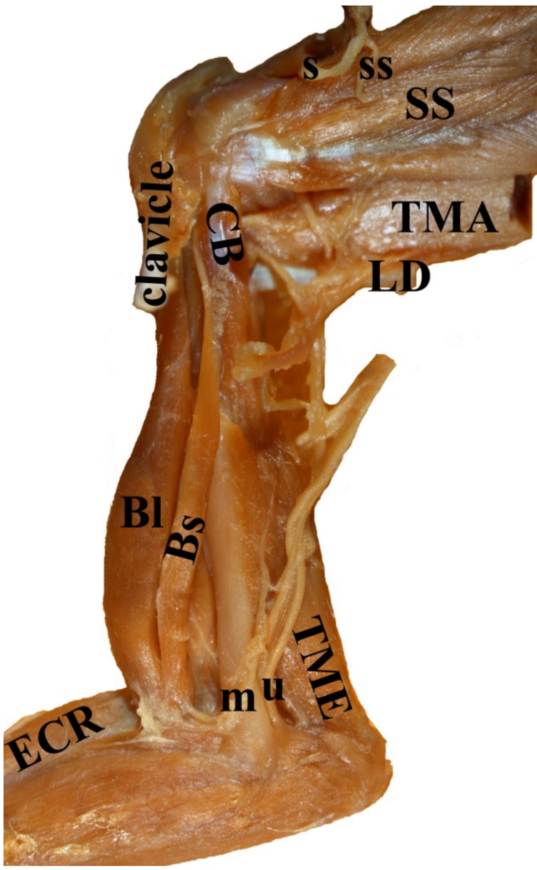
mm. coracobrachialis, biceps brachii, brachialis

M. coracobrachialis originates via tendinous fibers from the medial part of the bifid coracoid process. It fuses with the short head of m. biceps brachii and inserts via mixed fleshy and tendinous fibers in a line along the humerus extending distally to about midshaft, just lateral to the insertion of mm. teres major and latissimus dorsi. The musculocutaneous nerve runs deep to m. coracobrachialis but does not visibly pierce the muscle as in humans. It then runs deep and lateral to the short head of m. biceps brachii to supply both heads of mm. biceps brachii.

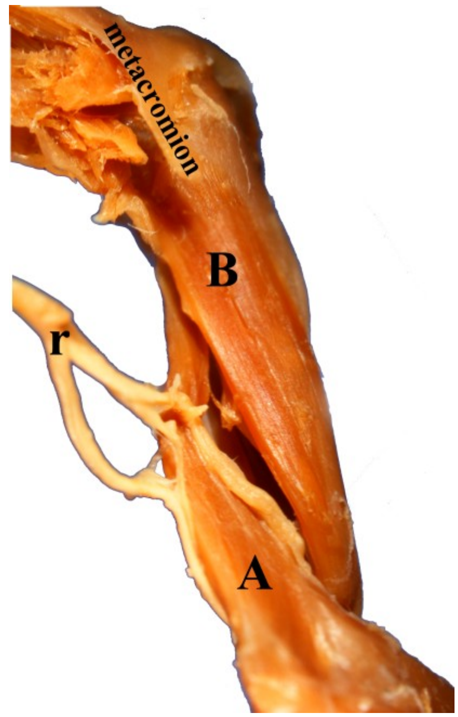
M. biceps brachii has two separable bellies. The medial belly, short head of m. biceps brachii, originates from the lateral part of the bifid coracoid process. The <0.5 mm wide shiny and ribbon-like tendon extends along the proximal third of the cranial surface of the humeral shaft and then fuses briefly with m. coracobrachialis. It continues on, medial to the long head of m. biceps brachii, twisting around m. brachialis to insert on the caudal aspect of the radial neck.

The lateral and larger belly, long head of m. biceps brachii, is 1.5 mm wide and originates from the supraglenoid tubercle. Its tendon glides in the bicipital groove and in the forearm its muscle belly has a tough aponeurotic connection with m. pronator teres. It inserts as a 2 mm-wide band on the medial ulna just distal to the coronoid process.

M. brachialis originates from the caudo-lateral edge of the greater tuberosity of the humerus, the caudal neck of the humerus, and for 1 mm just lateral to the deltopectoral crest. It inserts on the medial side of the ulna, via a round tendon which is surrounded by the insertions of mm. biceps brachii.



A.



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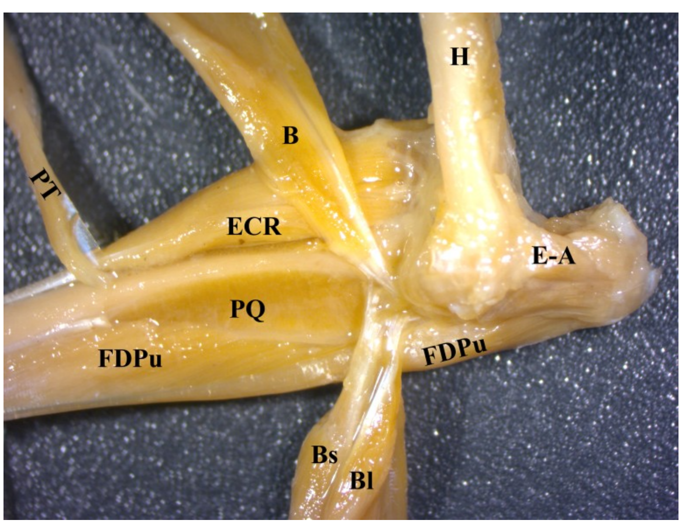


C.

Figure 3.3A-9. Muscles of the biceps group.

A. Medial view. B. Caudo-lateral view. C. Insertions, medial view (S-173518-0114).

[A- anconeus, B- brachialis, Bl- biceps brachii long head, Bs- biceps brachii short head, CB- coracobrachialis, E-A- epitrochleo-anconeus, ECR- extensor carpi radialis, PQ- pronator quadratus, TME- triceps brachii caput mediale]

I. SPINATI GROUP – SUPRASCAPULAR NERVE

mm. supraspinatus, infraspinatus

M. supraspinatus is pinnate with a large central tendon. The muscle takes origin from the supraspinous fossa, the cranial surface of the spine of the scapula, the cranial border of the scapula, and the cranial edge of m. subscapularis. It has a large, round, mixed fleshy and tendinous insertion on top of the greater tuberosity of the humerus.

M. infraspinatus is a pinnate muscle with fibers from the spine of the scapula and caudal and vertebral borders of the scapula all converging to a central tendon. It overhangs the caudal border of the scapula and covers the majority of the origin of m. teres major and completely covers m. teres minor. It inserts into a large facet on the lateral surface of the greater tubercle. It is not attached to the metacromion.

Figure 3.3A-10. Lateral right forelimb with mm. trapezius, deltoideus, rhomboideus, omotransversarius, and pectoralis superficialis removed.

J. TRICEPS GROUP – RADIAL NERVE

mm. dorso-epitrochlearis, triceps brachii (caput laterale, caput mediale, caput longum), anconeus

M. dorso-epitrochlearis is a thin sheet of muscle which, in the dissected specimen, is obscured by a great deal of fatty and lymphatic tissue in the axilla. It covers the caudal surface of m. triceps brachii caput longum and inserts on the caudo-medial olecranon.

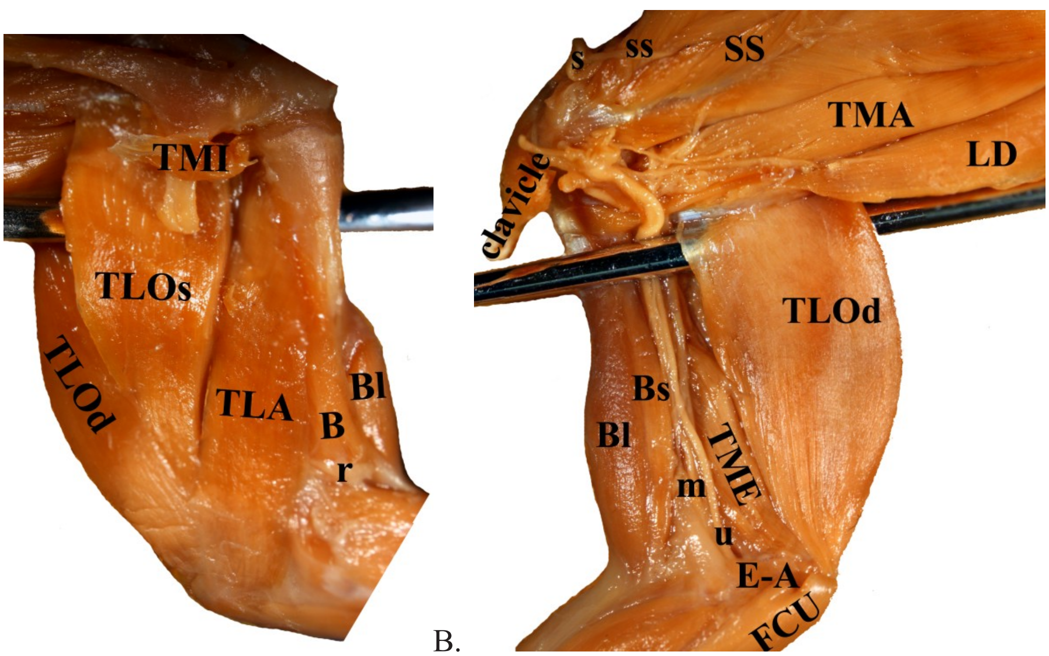
M. triceps brachii caput longum is partially covered by m. dorso-epitrochlearis. Once that thin sheet of muscle is peeled away, this portion of mm. triceps brachii is seen in lateral view to be made up of superficial and deep bellies as in other macroscelidids and *Orycteropus*. M. triceps brachii caput longum superficialis originates for 5 mm on the caudal border and the neck of the scapula. In lateral view, the muscle is thinner proximally where m. teres minor has left a groove on its superficial surface. M. triceps brachii caput longum profundus originates for 4 mm from the caudal surface of the neck of the scapula, immediately deep to the origin of the superficial belly. The two heads converge distally to a central area of thickened tendon which they share with m. triceps brachii caput laterale; the combined tendon then inserts on the caudal olecranon.

M. triceps brachii caput laterale has a 1.5 mm origin from the caudal surface of the neck of the humerus, splitting around the insertion of m. teres minor. The origin also sweeps laterally via tendinous fibers over the origin of m. brachialis. This portion of mm. triceps brachii appears flat in lateral view, but part of the muscle extends deep to fit into the space between mm. triceps brachii caput longum and brachialis. M. triceps brachii caput laterale fuses with mm. triceps brachii caput longum to form one large tendon that inserts on the caudo-lateral olecranon.

M. triceps brachii caput mediale is robust and covers the medial half of the caudal surface of the humerus, except the area around the entepicondylar foramen. This muscle inserts by fleshy fibers into the medial half of the cranial olecranon.

M. anconeus originates on the lateral half of the caudal surface of the distal humerus, deep to and fused with m. triceps brachii caput mediale. It inserts on the lateral half of the cranial olecranon. No fibers extend around the edge of the lateral epicondyle.

The radial nerve travels between mm. triceps brachii caput mediale and laterale, then splits at the elbow. The deep branch dives deep to the extensor muscles originating from the lateral epicondyle of the humerus. The superficial branch travels along the cranial aspect of the forearm to supply sensory innervation to the dorsum of the hand.



A. B.

Figure 3.3A-11. Mm. triceps brachii caput longum. A. Lateral view. B. Medial view.

[B- brachialis, Bl- biceps brachii long head, Bs- biceps brachii short head, E-A- epitrochleo-anconeus, LD- latissimus dorsi, m- median nerve, r- radial nerve, TLA- triceps brachii caput laterale, TLOd- triceps brachii caput profundus, TLOs- triceps brachii caput superficialis, TMA- teres major, TME- triceps brachii caput mediale]

K. EXTENSOR GROUP – RADIALNERVE

mm. brachioradialis, extensor carpi radialis longus et brevis, extensor digitorum communis, extensor digitorum lateralis, extensor carpi ulnaris, supinator, abductor pollicis longus, extensor digitorum profundus

M. brachioradialis is absent.

M. extensor carpi radialis has both longus and brevis heads of origin, although the bellies are mostly fused. M. extensor carpi radialis longus originates from the cranial surface of the lateral supracondylar crest proximal to the origin of m. extensor digitorum communis. M. extensor carpi radialis brevis originates deep and medial to the origin of m. extensor digitorum communis. The bellies fuse quickly and remain fleshy for 9 mm. They travel deep to the tendons of insertion of mm. abductor pollicis longus and extensor digitorum profundus to insert on the dorsomedial side of the base of metacarpal III and the dorsolateral side of metacarpal II.

M. extensor digitorum communis originates from the lateral epicondyle distal to the origin of m. extensor carpi radialis, and also extends in a line across the cranial surface of the distal humerus. The belly is 1 mm wide and fleshy for 1 cm before it splits into three tendons which pass through a groove on the distal radius. The tendons insert on the dorsomedial sides of digits IV and V, the dorsum of digit III, and the dorsolateral side of digit II.

M. extensor digitorum lateralis has two bellies of origin. The lateral belly is 6 mm long and originates from the lateral epicondyle in common with m. extensor carpi ulnaris. A small pit distal to the supracondylar ridge marks the location of this tendon of origin. The medial belly is smaller, only 5 mm long, and originates from the caudal surface of m. extensor digitorum communis. The two tendons cross into the carpus in a groove on the lateral radius around the base of digit V. The lateral belly inserts on the dorsolateral side of digit V, and the medial belly crosses deep to the tendon of m. extensor digitorum communis for digit V to insert on the dorsolateral side of digit IV.

M. extensor carpi ulnaris has a 2 mm wide origin from the lateral epicondyle with the lateral belly of m. extensor digitorum lateralis. It has a 9 mm long fleshy belly which inserts into the tubercle on the lateral side of the base of metacarpal V.

M. supinator is deep and originates via a tendon from the cranial surface of the lateral epicondyle. The belly is 7 mm long and inserts on the cranial surface of the radius, ending proximal and lateral to the insertion of m. pronator teres.

M. abductor pollicis longus is a pinnate muscle which originates from the proximal half of the lateral radius and ulna. Its belly is 8 mm long, then becomes a broad, flat tendon which wraps around the cranial surface of the distal humerus to insert on the medial side of the base of metacarpal I.

M. extensor digitorum profundus originates from the lateral ulna, beginning at a crest on the olecranon. It is fleshy for 1 cm and inserts on the dorsolateral side of digit I, the dorsomedial side of digit II, and also sends a tiny tendon to the dorsomedial side of digit III.

All the extensor muscles end as long, translucent tendons, and are thus very difficult to depict in a photograph.

A.

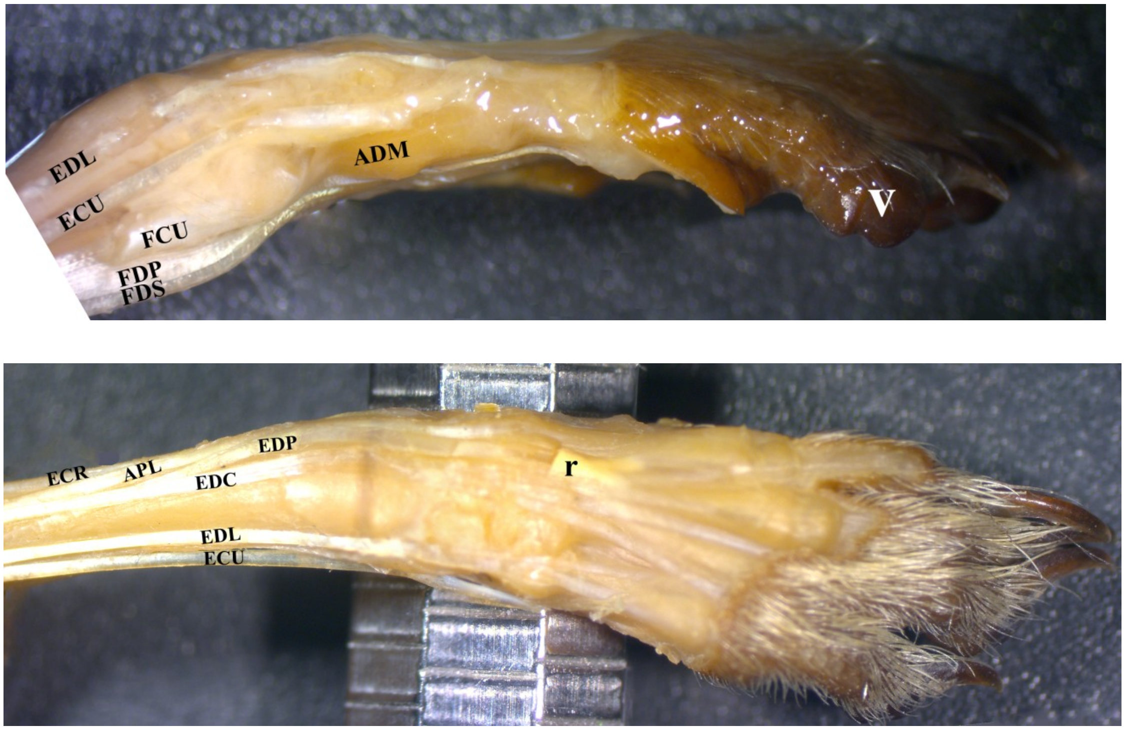
B.

C.

Figure 3.3A-12. Muscles originating from the lateral epicondyle, lateral view.

A. Mm. triceps brachii intact showing position of radial nerve. B. Mm. triceps brachii removed. C. Muscles originating from the lateral epicondyle removed showing the deep extensors (S-163421-0071).

[APL- abductor pollicis longus, B- brachialis, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, EDP- extensor digitorum profundus, LD- latissimus dorsi, P- supinator, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, TMA- teres major]



A.

B.

Figure 3.3A-13. Extensor tendons in the manus.

A. Lateral view (S175712-0135). B. Dorsal view. Ruler lines are 1 mm.

[ADM- abductor digiti minimi, APL- abductor pollicis longus, B- brachialis, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, EDP- extensor digitorum profundus, FCU- flexor carpi ulnaris, FDP- flexor digitorum profundus, FDS- flexor digitorum superficialis, r- radial nerve, v- digit V]

L. FLEXOR GROUP – MEDIAN and ULNAR NERVES

pronator teres^{m}, flexor carpi radialis^{m}, palmaris longus^{m}, flexor digitorum superficialis^{m}, flexor digitorum profundus^{m+u}, flexor carpi ulnaris^{u}, epitrochleo-anconeus^{u}, pronator quadratus^{m}

M. pronator teres has the most cranial origin from the medial epicondyle, and it is 1.5 mm wide. It inserts on the proximal third of the cranial surface of the radius.

M. flexor carpi radialis originates just cranial to and somewhat connected with the superficial epicondylar belly of m. flexor digitorum profundus. The 7 mm-long belly is fairly robust compared with its thin tendon, which is very tightly bound to the radial shaft. This tendon dives deep just lateral to digit I and inserts on the palmar surface of the base of metacarpal II.

M. palmaris longus is a small belly which originates from the medial epicondyle of the humerus and from m. flexor digitorum superficialis. After 7 mm the belly becomes completely tendinous. As it nears the carpus, there is a slip to the tendon of m. flexor digitorum profundus and the remainder of the insertion is at the flexor retinaculum.

M. flexor digitorum superficialis originates on the caudal surface of the medial epicondyle of the humerus with the deep epicondylar belly of m. flexor digitorum profundus. It is fleshy for 6 mm, then becomes a tendon which soon splits into three tendons that travel deep to the median nerve. The most medial (radial) tendon goes to the lateral edge of digit II, the middle tendon goes to the lateral edge of digit III, and the most lateral (ulnar) tendon goes to the lateral edge of digit IV.

The median nerve passes through the entepicondylar foramen and deep to pronator teres. It innervates all the muscles originating from the medial epicondyle, then splits into a deep portion that travels through the forearm along the superficial surface of m. pronator quadratus, and a superficial portion that travels on the deep surface of m. flexor digitorum superficialis. This branch is visible just medial to the tendon of m. flexor carpi radialis. At the carpus, it crosses superficial to the tendons of m. flexor digitorum superficialis, and in the manus travels medially to its tendons to supply sensory innervation to digits II-IV.

M. flexor digitorum profundus has two bellies from the epicondyle, both receiving median nerve innervation, and a belly from the ulna, which receives ulnar nerve innervation. The superficial epicondylar belly of m. flexor digitorum profundus originates between the origins of the humeral head of m. flexor carpi ulnaris, from which it is completely free, and m. flexor carpi radialis, with which it shares a few fibers. A branch of the median nerve enters the deep surface of the muscle just after its origin. It inserts on the medial edge of the conjoined tendon of m. flexor digitorum profundus. The deep epicondylar belly of m. flexor digitorum profundus is a few fibers originating from the deep surface of m. flexor digitorum superficialis. Its fibers promptly insert on the ulnar head of m. flexor digitorum profundus, although its long tendon remains distinct on the medial side of the conjoined tendon of m. flexor digitorum profundus. The ulnar belly of m. flexor digitorum profundus originates partially from m. pronator quadratus, but mostly from the entire flat caudo-medial surface of the ulna and olecranon. Several tendons form on the surface of the ulnar belly, and at the carpus they are the first to join into the conjoined tendon of m. flexor digitorum profundus.

The conjoined tendon crosses the carpus, where it glides over three cartilaginous plates, and then splits into five tendons. The medial (radial) tendon is the smallest and inserts on the distal phalanx of digit I. Beginning at the metacarpophalangeal joint of each digit, the other four tendons travel through fibrous sheaths to insert on the distal phalanges of digits II-V.

M. flexor carpi ulnaris has two heads of origin. The epicondylar head originates via mixed fleshy and tendinous fibers from the distal end of the medial epicondyle. The ulnar head originates from the crest on the caudal edge of the medial olecranon. The two heads fuse promptly after origin and remain fleshy for 1.3 cm. M. flexor carpi ulnaris inserts via a strong, broad tendon into the pisiform.

M. epitrochleo-anconeus is a very slender slip of muscle that spans the ulnar nerve. It originates on the caudal surface of the medial epicondyle and inserts into the caudo-medial surface of the proximal end of the ulnar head of origin of m. flexor carpi ulnaris.

The ulnar nerve travels deep to m. epitrochleo-anconeus, then sends branches into both heads of origin of m. flexor carpi ulnaris and the ulnar belly of m. flexor digitorum profundus. Then the nerve runs along the deep surface of m. flexor carpi ulnaris, and is on the lateral edge of the muscle tendon as it crosses into the carpus. In the manus it travels medial to m. abductor digiti minimi.

M. pronator quadratus is fleshy and fairly extensive, despite the fusion of the radius and ulna. The muscle is 8 mm long and 2 mm wide and located in the proximal third of the forearm.

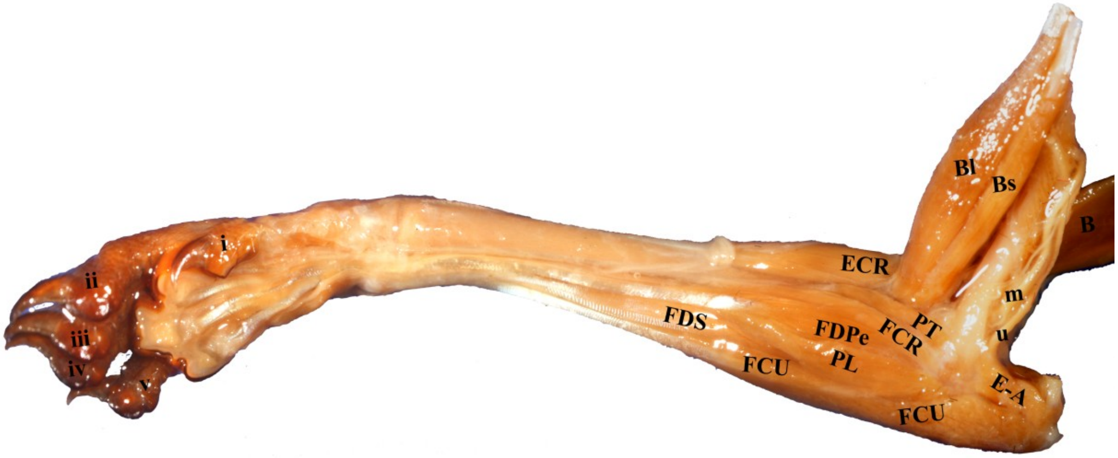


Figure 3.3A-14. Muscles originating from the medial epicondyle, medial view.

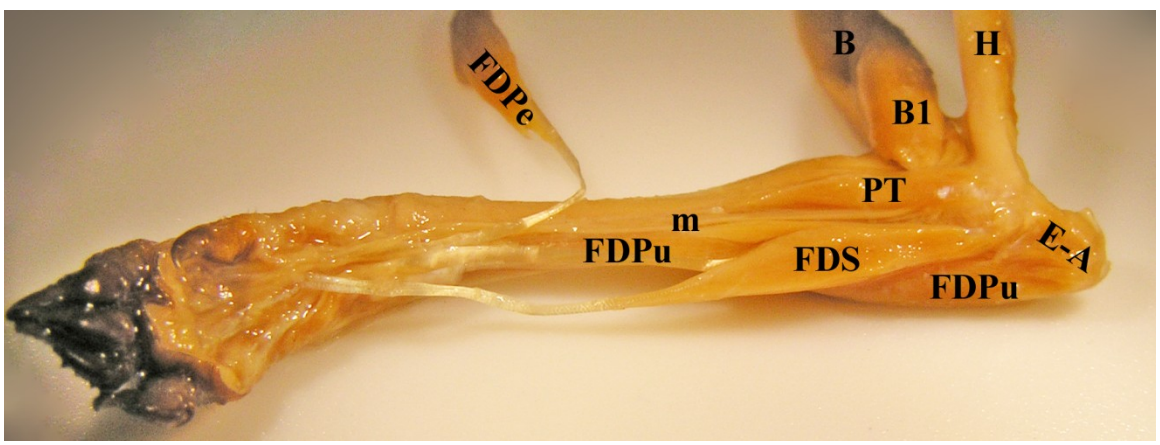


Figure 3.3A-15. M. flexor digitorum superficialis, caudo-medial view (P7093523).

Figure 3.3A-16. M. flexor carpi ulnaris, caudo-lateral view.

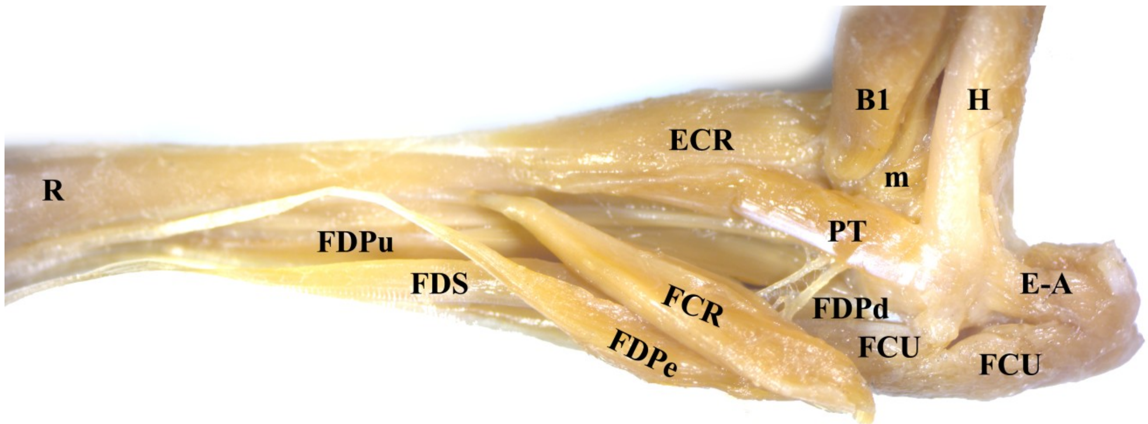


Figure 3.3A-17. Median nerve in forearm, passing deep to m. pronator teres.

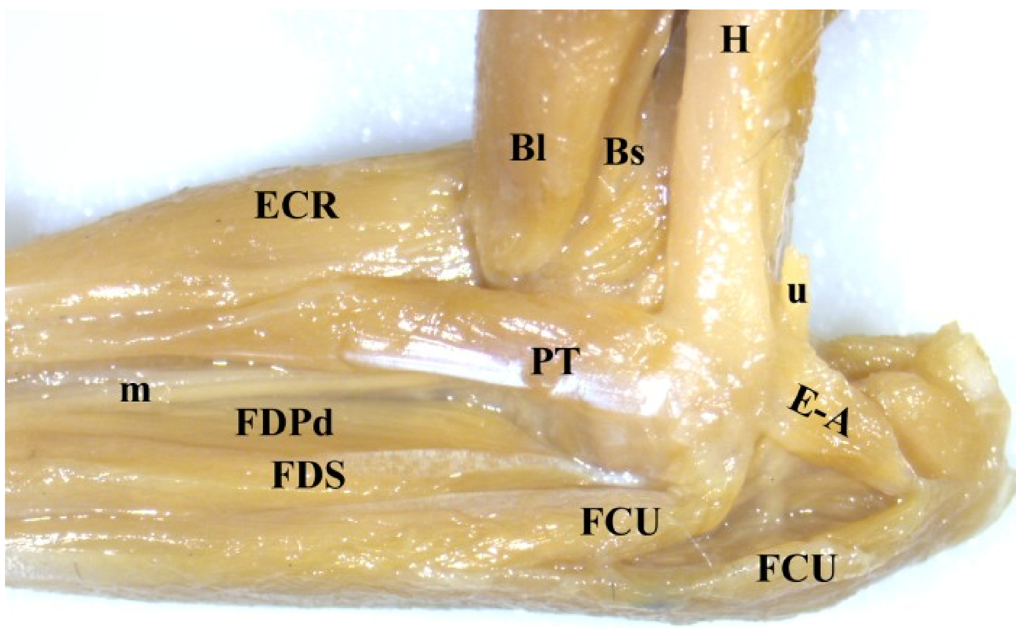


Figure 3.3A-18. Ulnar nerve, passing deep to m. epitrochleo-anconeus.

[ADM- abductor digiti minimi, B- brachialis, Bl- biceps brachii long head, Bs- biceps brachii short head, E-A- epitrochleo-anconeus, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, FDPd- deep epicondylar head of flexor digitorum superficialis, FDPe- superficial epicondylar head of flexor digitorum profundus, FDPu- ulnar head of flexor digitorum superficialis, FDS- flexor digitorum superficialis, H- humerus, m- median nerve, PL- palmaris longus, PT- pronator teres, R- radius, u- ulnar nerve]

M. MANUS GROUP – MEDIAN and ULNAR NERVES

palmaris brevis, flexor digitorum brevis manus, lumbricales^{m+u}, abductor digiti minimi^{u}, abductor pollicis brevis, contrahentes^{u}, flexor digitorum breves profundus^{u}

I did not observe m. palmaris brevis in *Elephantulus.* However, Haines (1955) observed a muscle attached to the enlarged hypothenar pad in *E. myurus*, similar to what I observed in *Potamogale*. Presumably, this is m. palmaris brevis, so it is possible I overlooked the muscle or it exhibits variation within the genus.

I discerned only one belly of m. flexor digitorum brevis manus, originating from the palmar fascia and inserting distal to m. abductor digiti minimi on the lateral side of metacarpal V.

Four mm. lumbricales, originate from the tendons of m. flexor digitorum profundus. They insert on the medial side of the proximal phalanges of digits II-V.

M. abductor digiti minimi originates from the pisiform and inserts on the lateral side of metacarpal V. M. abductor pollicis brevis is absent.

There are three mm. contrahentes in the manus. They originate from the deep fascia over the carpals and insert on the lateral sides of digits I and II and the medial side of digit V. M. contrahens for digit I is very tiny. Haines (1955) reported that the mm. contrahentes are innervated by the ulnar nerve.

Mm. flexor digitorum breves profundus are ten in number, one pair for each metacarpal. There is no special development of the most lateral muscle, m. flexor digiti minimi brevis, or the most medial muscle, m. flexor pollicis brevis, nor are any opponens muscles differentiated from mm. flexor digitorum breves profundus.

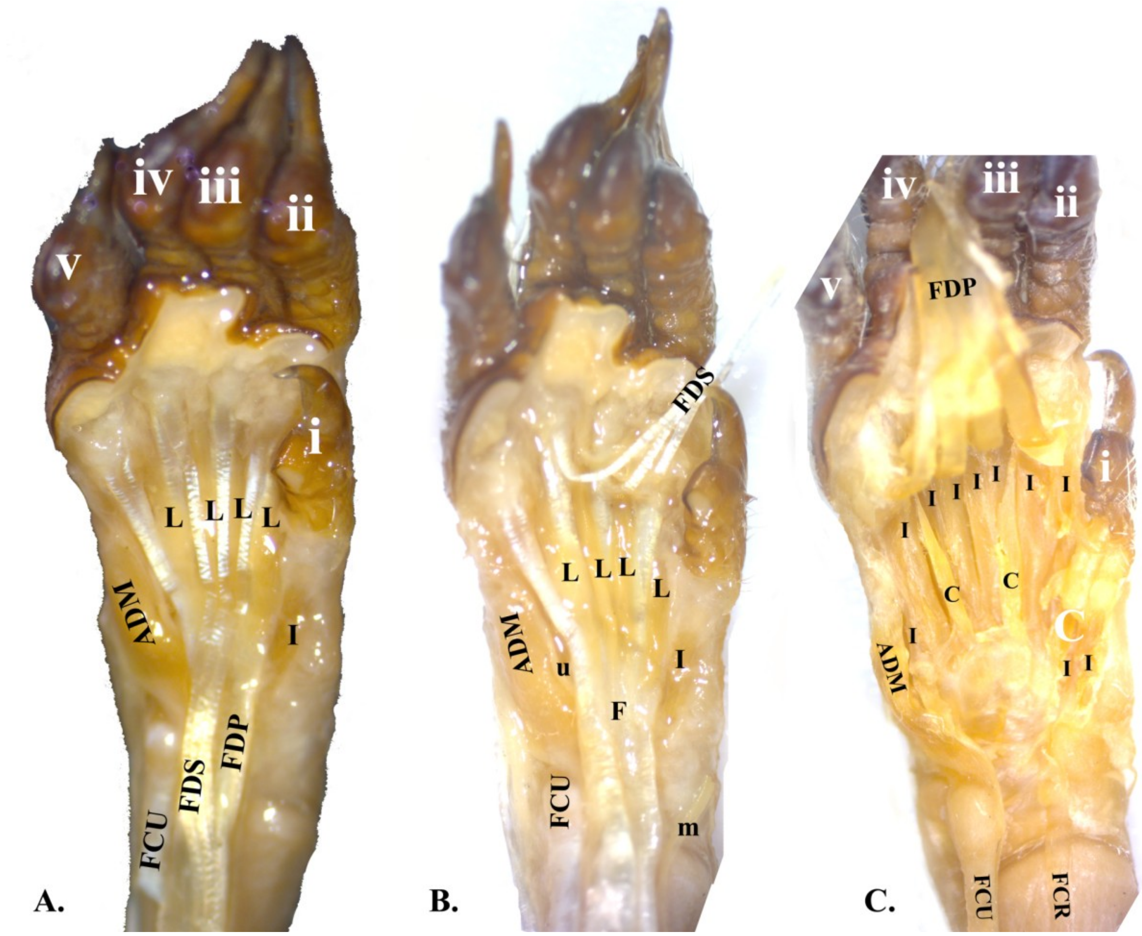
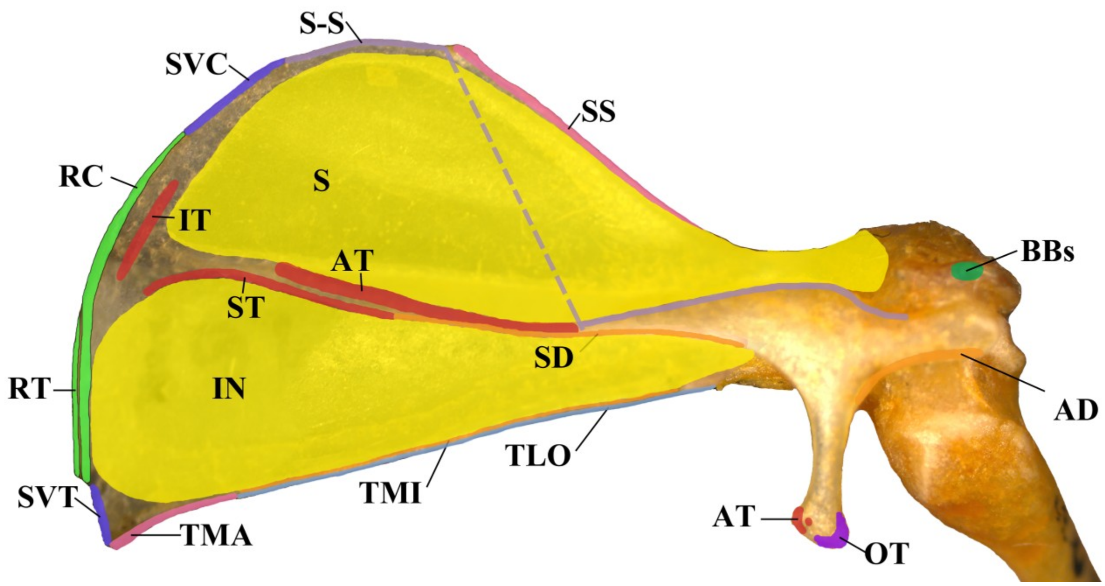


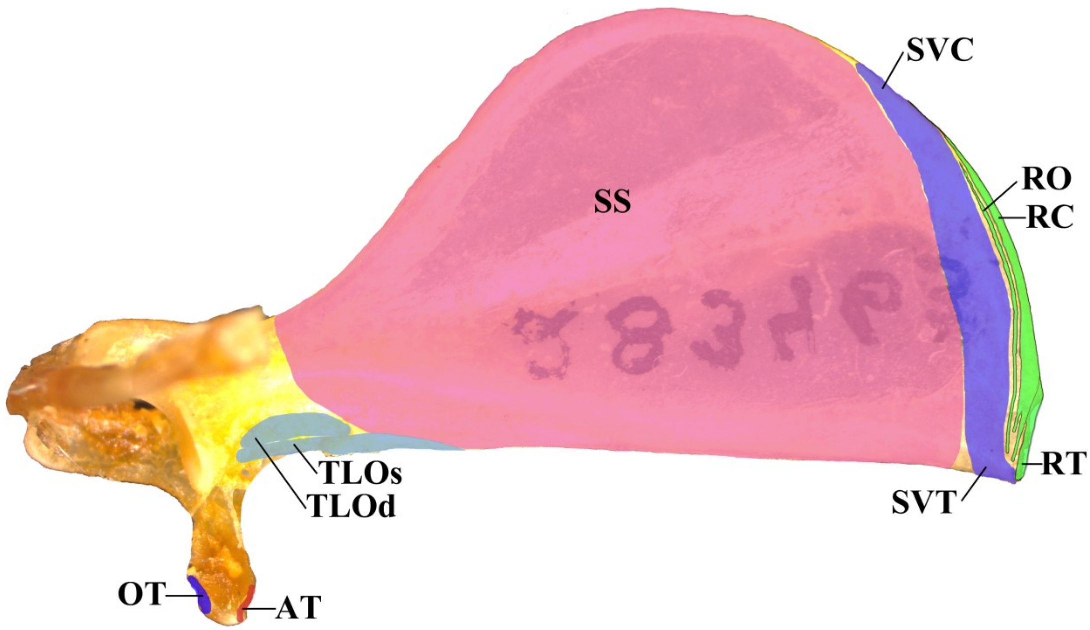
Figure 3.3A-19. Muscles of the manus.

A. Flexor tendons in situ. B. Tendons of m. flexor digitorum superficialis reflected. C. Tendons of mm. flexores digitorum superficialis et profundus reflected (S-144131-0011)

[ADM- abductor digiti minimi, C- contrahentes, I- flexor digitorum breves profundus, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, FDS- flexor digitorum superficialis, FDP- flexor digitorum profundus, L- lumbricales]



A.



B.

Figure 3.3A-20. Muscle attachment maps for the scapula.
A. Superficial surface of the scapula. B. Deep surface of the scapula.

[AD- acromiodeltoideus, AT- acromiotrapezius, BBl – glenoid (long) head of biceps brachii, BBs – coracoid (short) head of biceps brachii, CB- coracobrachialis, IN- infraspinatus, OT – omotransversarius, RC- rhomboideus cervicis, RO- rhomboideus capitis, RT- rhomboideus thoracis, S- supraspinatus, S-S- sternoscapularis, SS – subscapularis, ST – spinotrapezius, SV- serratus ventralis, SVC- serratus ventralis cervicis, TLOd – triceps brachii caput longum profundus, TLOs - triceps brachii caput longum superficialis, TMA – teres major, TMI – teres minor]

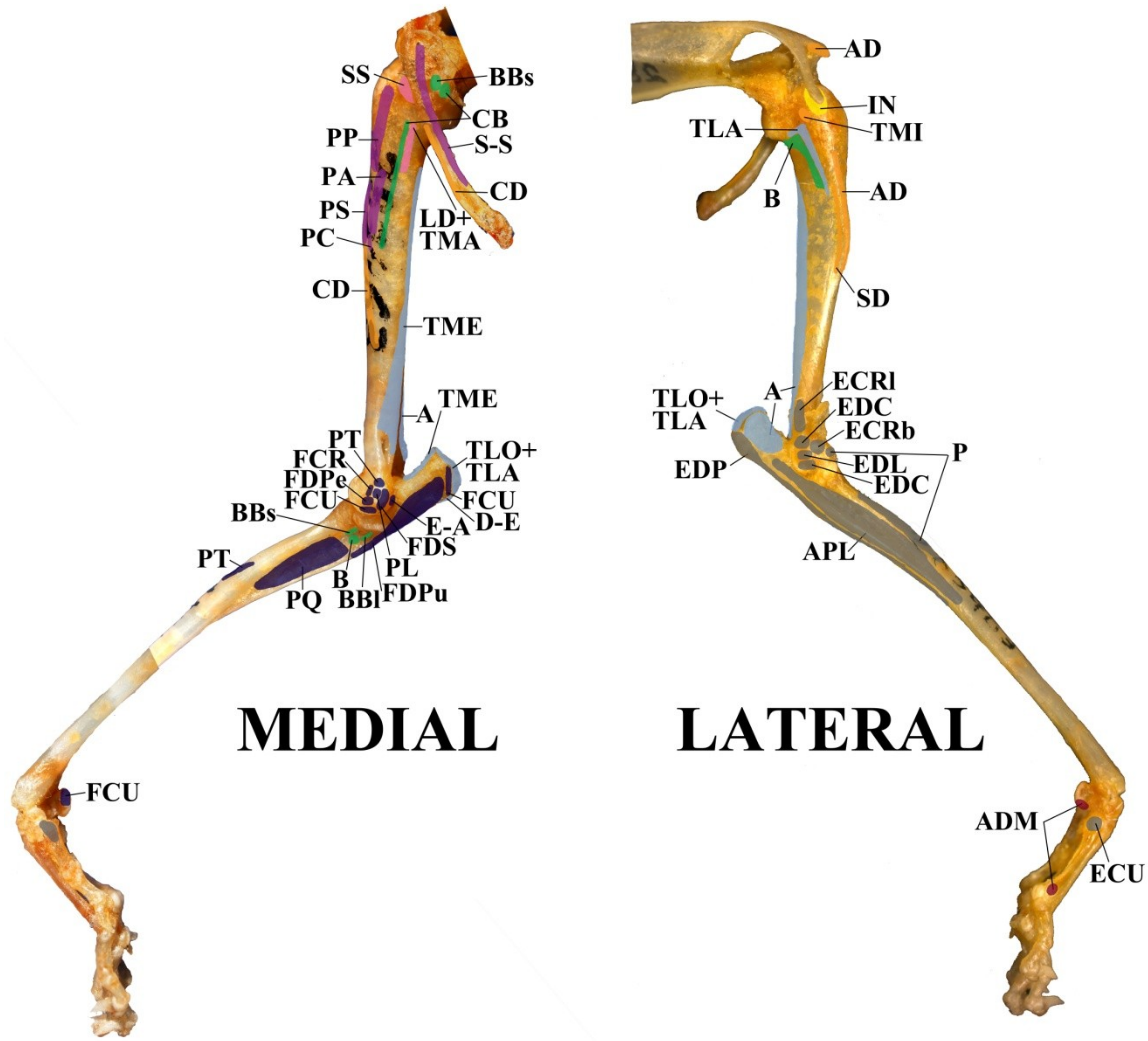


Figure 3.3A-21. Muscle attachment maps for the humerus, radius, ulna, and manus.

[A – anconeus, AD- acromiodeltoideus, ADM – abductor digiti minimi, APL – abductor pollicis longus, B – brachialis, BBl – glenoid (long) head of biceps brachii, BBs – coracoid (short) head of biceps brachii, D-E – dorso-epitrochlearis, E-A – epitrochleo-anconeus, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL – extensor digitorum lateralis, EDP – extensor digitorum profundus, FCR – flexor carpi radialis, FCU – flexor carpi ulnaris, FDPe – superficial epicondylar head of flexor digitorum profundus, FDPu – ulnar head of flexor digitorum profundus, IN – infraspinatus, LD- latissimus dorsi, P – supinator, PL- palmaris longus, PP- pectoralis profundus, PS- pectoralis superficialis, PT – pronator teres, S- supraspinatus, S-S- sternoscapularis, SD- spinodeltoideus, SS- subscapularis, TLA – triceps brachii caput laterale, TLOd – triceps brachii caput longum profundus, TLOs – triceps brachii caput longum superficialis, TMA- teres major, TME – triceps brachii caput mediale, TMI - teres minor]

3.3B – Macroscelidea – Macroscelididae – *Petrodromus tetradactylus tordayi*

The forelimb anatomy of *Petrodromus* was previously described by Jullien (1967) and compared with species now considered members of Lipotyphla and Afrotheria. I provide here a new description of the extrinsic and intrinsic muscles of the forelimb of a male specimen of *Petrodromus tetradactylus tordayi*, the Four-toed Elephant Shrew (Macroscelidea: Macroscelididae), collected for the American Museum of Natural History in the Democratic Republic of Congo in 1931. Despite 80 years preserved in alcohol, the specimen is in excellent condition. An incision through the abdominal wall and into the thigh has disrupted the condition of some muscles, as noted in the text. Due to the small size of the animal, dissections were performed under a microscope. There is a small pollux on the right forefoot, no pollux on the left forefoot, and no hallux on both hind feet.

Figure 3.3B-1. Pre-dissection photograph of *P. tetradactylus*, AMNH 86936 (P3180005).

0. CUTANEOUS MUSCULATURE

mm. cutaneous ventralis, sphincter colli, panniculus carnosus, dorsocutaneous

M. cutaneous ventralis was inconsequential or absent.

M. sphincter colli originates from the occipital midline and extends 4 mm before ending in the ventral neck proximal to the insertion of m. sternomastoideus.

M. panniculus carnosus originates from the dorsal midline, extends for 2.5 cm in an arc around the shoulder, and covers the thigh to the knee. It inserts on the humerus, just as in *Elephantulus*. There are two points of connection with mm. pectoralis, and three intercostal nerves enter its deep surface. Proximally, near the caudal angle of the scapula there is much fatty or lymphoid tissue covered by this muscle. Two lymph nodes were observed in the thorax near the axilla, overlying the panniculus carnosus.

M. dorsocutaneous was not observed, but see the description of the unusual m. intermediate trapezius. The m. interemediate trapezius may be m. dorsocutaneous which has achieved a bony insertion.

A. 

B. 

Figure 3.3B-2. M. panniculus carnosus [PC].

A. Ventral view showing absence of ventral cutaneous musculature (P3280021). B. M. panniculus carnosus, lateral view (P3280016).

A. TRAPEZIUS GROUP – ACCESSORY NERVE and CERVICAL NERVES

mm. sternomastoideus, cleidomastoideus, clavotrapezius, acromiotrapezius, "intermediate trapezius," spinotrapezius

M. sternomastoideus originates with m. cleidomastoideus from the mastoid process, and is the more ventral and superficial of the two muscles. It emerges from deep to the common carotid artery to travel medial to it into the ventral neck. It is 4 mm wide and 3.8 cm long, inserting on the surface of the manubrium and covering a portion of m. pectoralis superficialis.

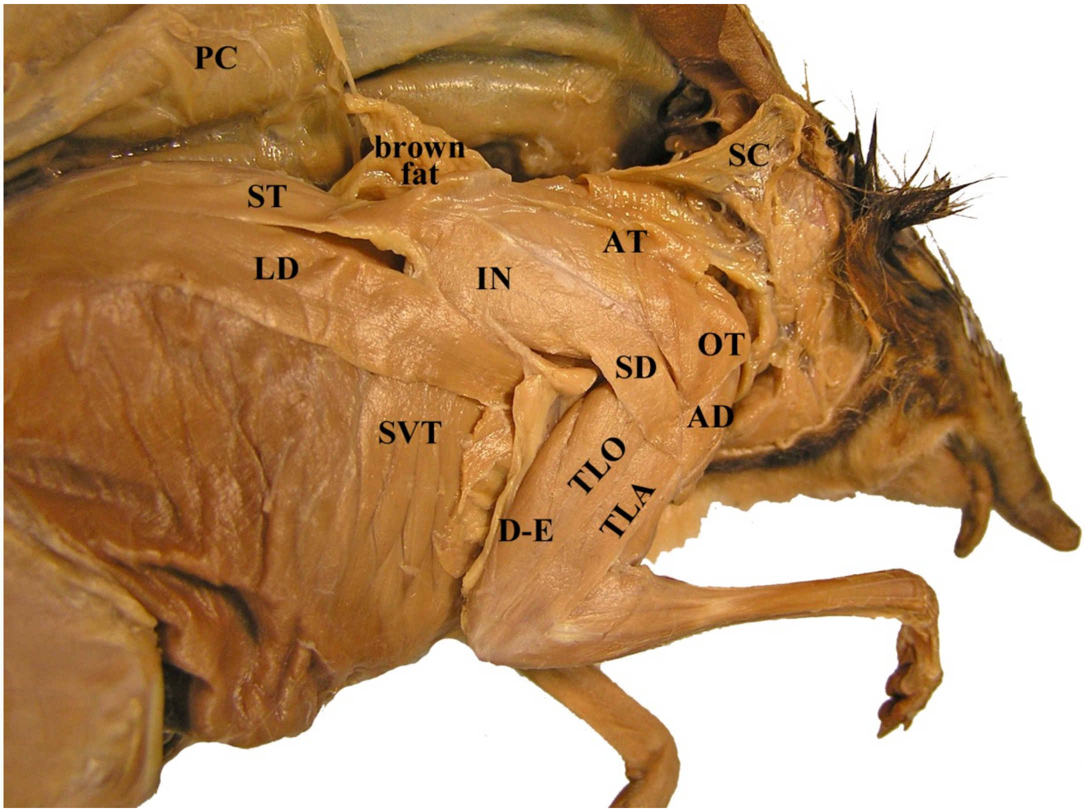
M. cleidomastoideus originates from the mastoid process lateral to m. sternomastoideus. The muscle is 4 mm wide and 2 cm long. It inserts on the medial end of the clavicle and jugular notch of the manubrium. An insertion of m. cleidomastoideus on the manubrium has been observed in other macroscelidids (Jullien, 1967).

M. clavotrapezius is a tiny ribbon of muscle, only 3 mm wide and 3 cm long. It originates along the occipital crest, where it is superficial but closely applied to m. acromiotrapezius and also superficial to m. cleidomastoideus. This muscle directs ventrally, travelling along the base of the pinna and then along the dorsal side of m. cleidomastoideus to insert on the cranial edge of the medial third of the clavicle. It is separated from m. acromiotrapezius by the great auricular nerve. The muscle is hidden by a salivary gland, presumably the parotid gland, around the base of the pinna.

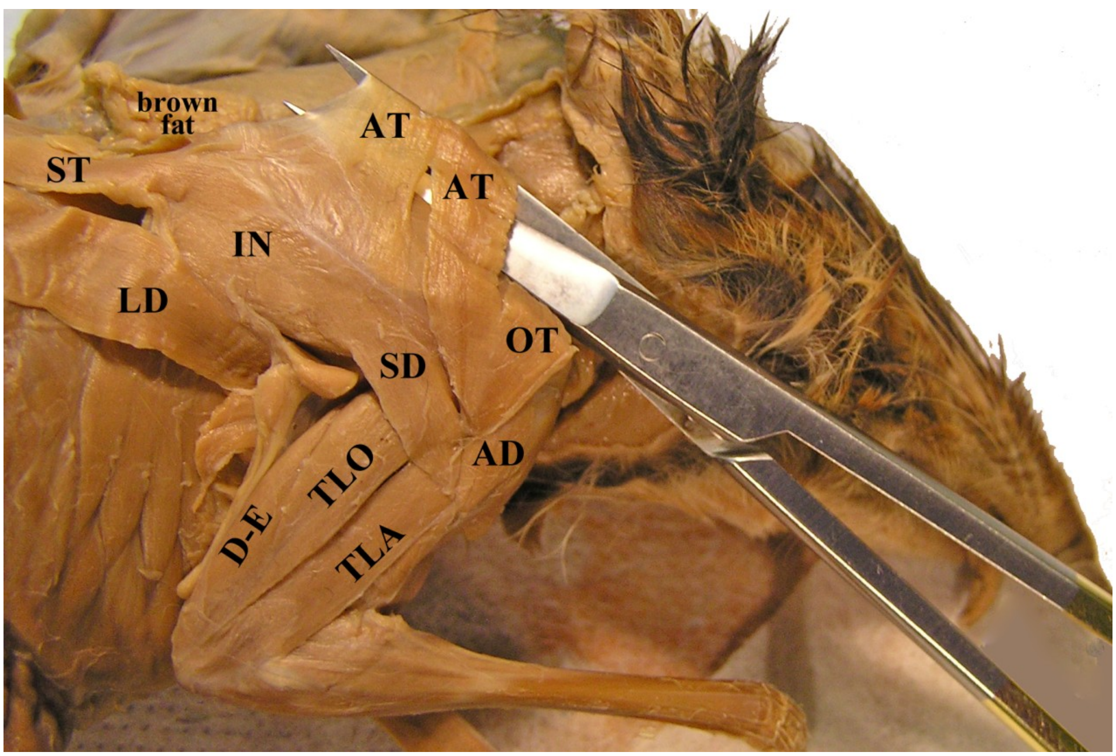
M. acromiotrapezius originates for 17 mm along the dorsal midline, from the occiput and all the cervical vertebrae. The muscle shows evidence of a split into two portions, but this is quickly obliterated by a connection between the portions. This connection extends for 1 cm before the muscle clearly bifurcates into two distinct portions, cranial and caudal, which have different insertions. The cranial portion is thicker and has fibers directed toward the metacromion, where it narrows to insert via fleshy fibers just dorsal to the insertion of m. omotransversarius. The caudal portion is extremely thin and inserts widely into fascia over m. supraspinatus. Its fascia is also connected with that of the insertion of m. rhomboideus thoracis. Its fibers are directed more caudally than the cranial portion.

"M. intermediate trapezius" originates from the caudal end of the ligamentum nuchae and inserts opposite the termination of the scapular spine along the vertebral border of the scapula. It has a connection with the caudal half of m. acromiotrapezius. This unusual "m. intermediate trapezius" is only observed in macroscelidids, and this is a name I designated for the muscle as Jullien (1967) refered to the muscle as "une lame charnue." Other members of the Afrotheria possess a similarly situated cutaneous muscle derived from the trapezius complex called, m. dorsocutaneous. It is possible that in *Petrodromus* and the other Macroscelidea, "m. intermediate trapezius" is really m. dorsocutaneous which has achieved an actual bony insertion.

M. spinotrapezius is superficial to latissimus dorsi and encased in fatty fascia that links it with mm. rhomboideus. Lymph nodes along the muscle are connected to lymph nodes in the axilla by vessels that run over m. latissimus dorsi as well as to the brown fat between the scapulae. The muscle originates via tendinous fibers from the first lumbar vertebrae as in other macroscelidids (Jullien, 1967). At 4 mm wide for its entire course, the muscle is long and narrow and paper thin. It inserts via fleshy fibers on the base of the caudal aspect of the scapular spine, covering part of m. infraspinatus.



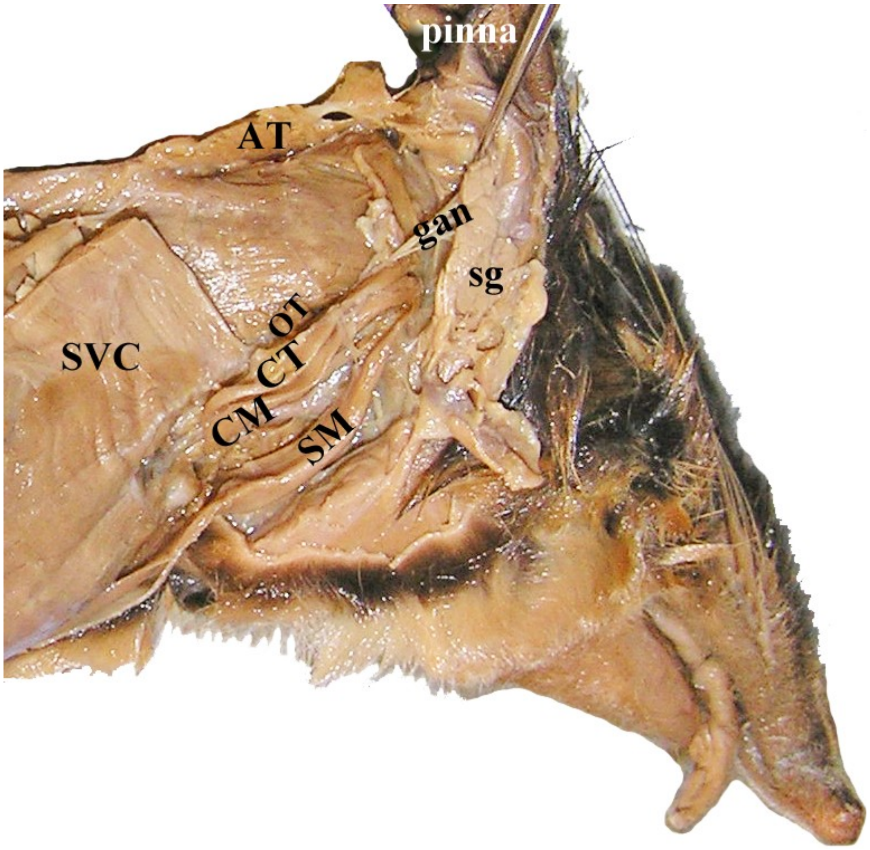
A.



B.

Figure 3.3B-3. Trapezius complex.

A. Superficial lateral view (P6020025). B. Superficial lateral view showing bifid m. acromiotrapezius (P6020037)



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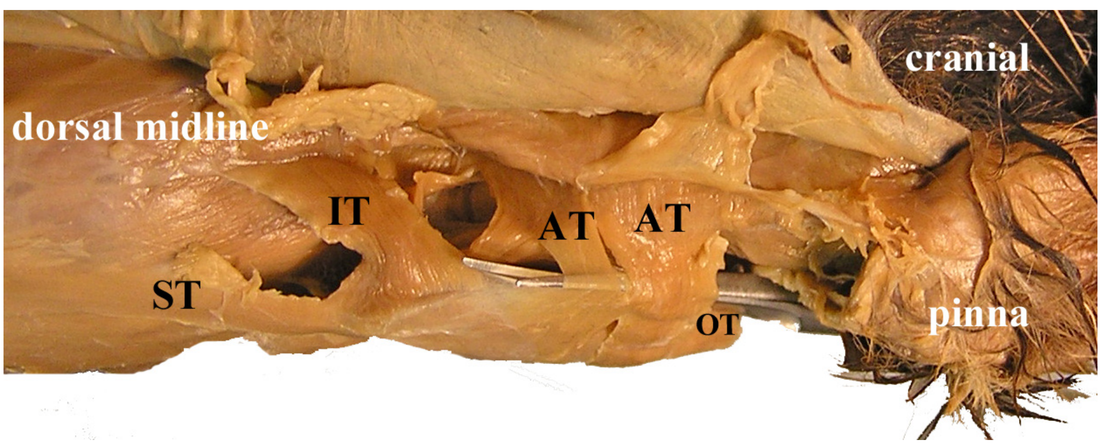


D.

Figure 3.3B-3 continued. Trapezius complex. C. Deep lateral view; forelimb has been removed. Note great auricular nerve [gan] caudal to m. clavotrapezius (P9262120). D. Dorsal view, showing “m. intermediate trapezius” (P6020042).

[AT- acromiotrapezius, CM- cleidomastoideus, CT- clavotrapezius, gan- great auricular nerve, IT- “intermediate trapezius,” OT- omotransversarius, sg- salivary gland, SM- sternomastoideus, ST- spinotrapezius, SVC- serratus ventralis cervicis]

B. RHOMBOID GROUP – DORSAL SCAPULAR NERVE
mm. rhomboideus capitis, rhomboideus cervicis, rhomboideus thoracis

M. rhomboideus capitis has a 5 mm wide origin on the occiput, deep and cranial to the origin of m. acromiotrapezius, which covers most of m. rhomboideus capitis so that only 3 mm is visible. The muscle fibers are long, stretching for 2 cm. The muscle inserts in a 6 mm wide line on the deep surface of the vertebral border of the scapula.

M. rhomboideus cervicis originates as two digitations 1 cm caudal to the origin of m. rhomboideus capitis and 1.5 cm cranial to the origin of m. rhomboideus thoracis. The more proximal digitation is 3 mm wide and has a slightly deeper origin than the more distal digitation, which is 5 mm wide. The two digitations insert together for 1 cm along the deep surface of the vertebral border of the scapula.

M. rhomboideus thoracis is flatter and more weakly developed than the other portions of mm. rhomboideus. It is 4 mm wide and originates from three distal thoracic vertebrae. This muscle is covered by a brown fat pad. It extends 1 cm before inserting on the edge of the vertebral border of the scapula.

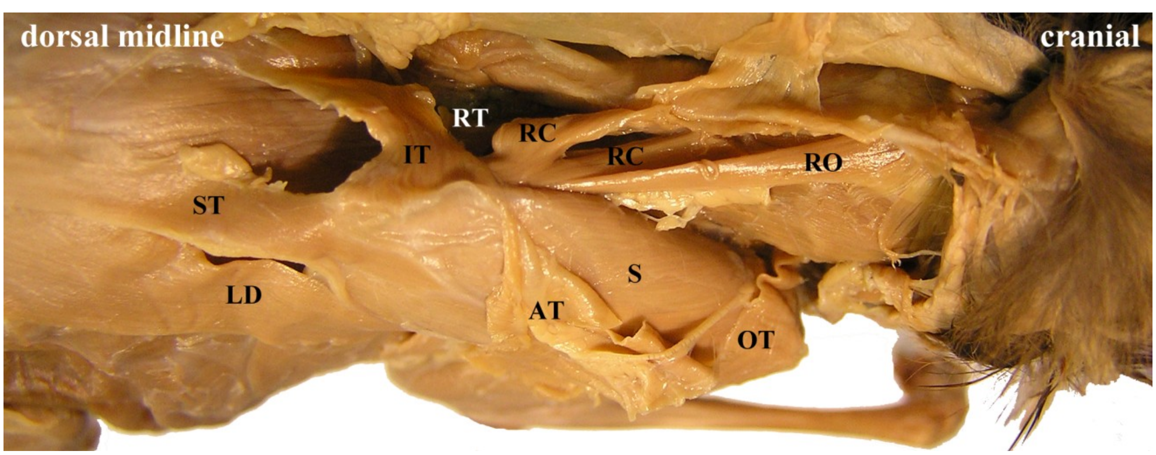


Figure 3.3B-4. Mm. rhomboideus, dorso-lateral view (P6020048).

C. OMO GROUP – CERVICAL NERVES, LONG THORACIC NERVE

mm. omotransversarius, omohyoideus, serratus ventralis (cervicis, thoracis)

M. omotransversarius originates from the atlas, and its fibers are directed ventrally and caudally. It is a slender 2 mm at its origin and broadens and flattens to 5 mm for its insertion on the tip of the metacromion, where it slightly overlaps the caudal edge of the cranial portion of m. acromiotrapezius.

M. omohyoideus is absent.

M. serratus ventralis cervicis originates by two digitations from the transverse processes of cervical vertebrae. This muscle is 1.2 cm wide and inserts in a 14 mm wide band from the cranial angle of the scapula along the ventral surface of the vertebral border of the scapula. The insertion is just lateral to the insertions of mm. rhomboideus muscles, and merges slightly with the insertion of m. serratus ventralis thoracis.

The origin of m. serratus ventralis thoracis is by four very distinct digitations from ribs. This muscle is 1.5 cm wide, and it is connected by fascia to m. serratus ventralis cervicis. The digitations of m. serratus ventralis thoracis retain their shape but merge together and converge toward the caudal angle of the scapula. The slight projection of the vertebral border of the scapula here seems to be only for this attachment, and where the muscle inserts is visible on the bone.

Deep to mm. serratus ventralis is a large sheet of fatty tissue, as well as a large lymph node and a smaller chain of lymph nodes.

D. DELTOID GROUP – AXILLARY NERVE

mm. clavodeltoideus, acromiodeltoideus, spinodeltoideus, teres minor

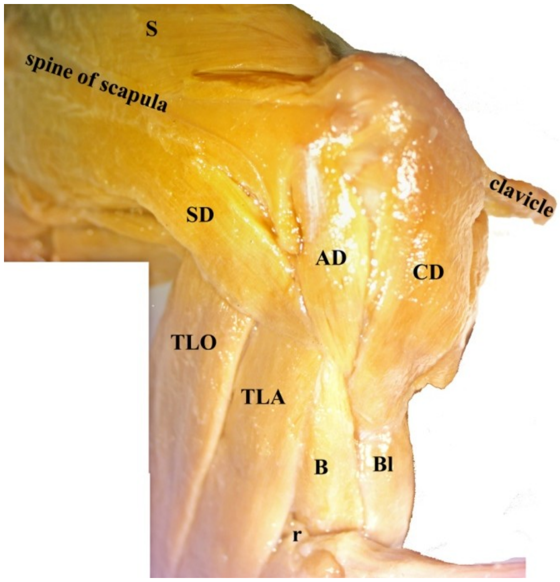
<u>M. clavodeltoideus</u> covers the cranial shoulder, extending for 1.5 cm from its origin to insertion. The muscle originates for 6 mm along the caudal surface of the lateral clavicle and inserts via tendinous fibers for 1 cm on the distal deltopectoral crest and cranio-lateral humerus, just lateral to the insertion of m. pectoralis superficialis, and with some connection between the two muscles. The insertion is incipiently bifid, with a few fleshy fibers inserting, then a gap, and then the rest of the insertion.

<u>M. acromiodeltoideus</u> has a shiny white central tendon at its 4 mm wide origin from the acromion. The rest of the 1 cm long muscle is fleshy, and it inserts robustly for 6 mm on the lateral deltopectoral crest of the humerus, lateral to the insertion of m. clavodeltoideus and medial to the insertion of m. spinodeltoideus.

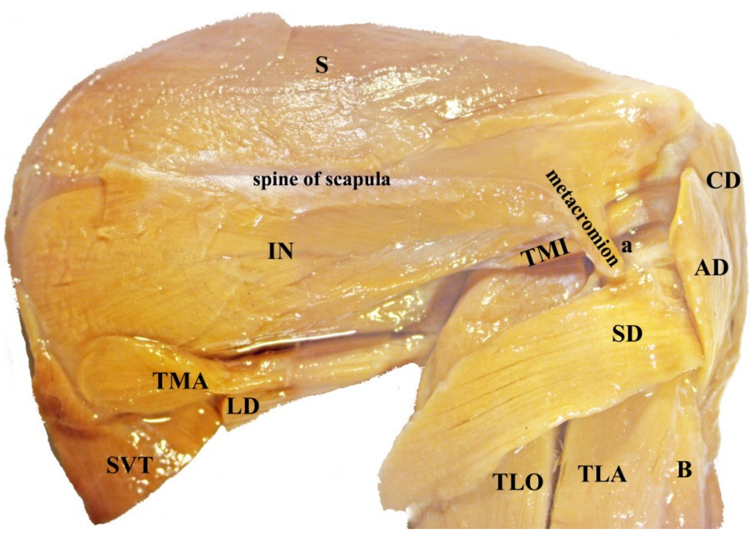
<u>M. spinodeltoideus</u> originates from the spine of the scapula and is connected also to the deep surface of the tip of the metacromion. Its 5 mm-wide tendinous fascia of origin also stretches over the surface of m. infraspinatus. The muscle is 1.5 cm long and inserts via thin tendinous fibers for 6 mm along the craniolateral humerus, just lateral to the insertion of m. acromiodeltoideus and medial to m. triceps brachii caput laterale.

<u>M. teres minor</u> is only 8 mm long and completely hidden at origin by m. spinodeltoideus and at insertion by m. acromiodeltoideus. It originates via tendinous fibers from the surface of m. infraspinatus and the caudal border of the scapula. The muscle inserts via tendon onto a slight fossa on the lateral greater tuberosity, distal to the insertion of m. infraspinatus.

The axillary nerve emerges from between the metacromion and the humerus to supply the muscles of the deltoid group.



A.



B.

Figure 3.3B-5. Mm. deltoideus and teres minor.

A. Lateral view. B. Deep lateral view; mm. spinodeltoideus and acromiodeltoideus reflected, showing m. teres minor.

[a- axillary nerve, AD- acromiodeltoideus, B- brachialis, Bl- biceps brachii long head, CD- clavodeltoideus, IN- infraspinatus, LD- latissimus dorsi, r- radial nerve, S- supraspinatus, SD- spinodeltoideus, SVT- serratus ventralis thoracis, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, TMA- teres major, TMI- teres minor]

E. SUBSCAPULARIS GROUP – SUBSCAPULAR NERVE

mm. subscapularis, teres major

M. subscapularis originates from the subscapular fossa and from the deep cranial edge of m. supraspinatus. Two central tendons and their associated muscle fibers converge to a very robust tendon that inserts on the lesser tuberosity, deep to the tendon of the short head of m. biceps brachii and m. coracobrachialis.

M. teres major originates by two heads that are almost separate muscles. The dorsal portion originates via fleshy fibers from the caudal angle of the scapula and for 5 mm along the caudal border of the scapula. The ventral portion also has a bony origin along 1 cm of the caudal border of the scapula but is more connected with m. subscapularis. Together, the two parts of the muscle are robust, and each receives a branch of the subscapular nerve. The muscle inserts with m. latissimus dorsi along a rugose line on the proximal end of the cranio-medial humerus.

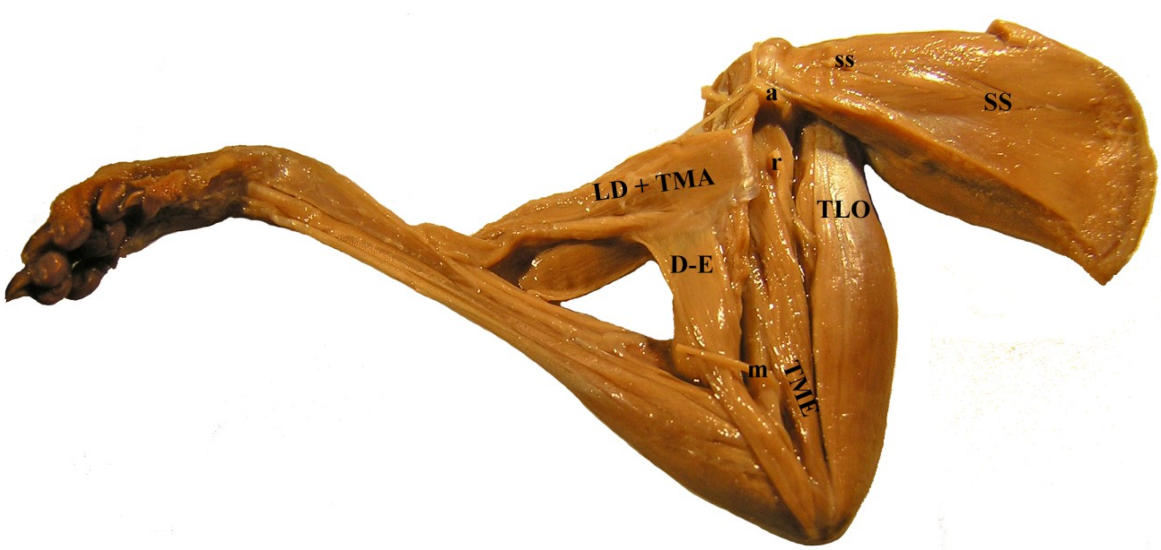
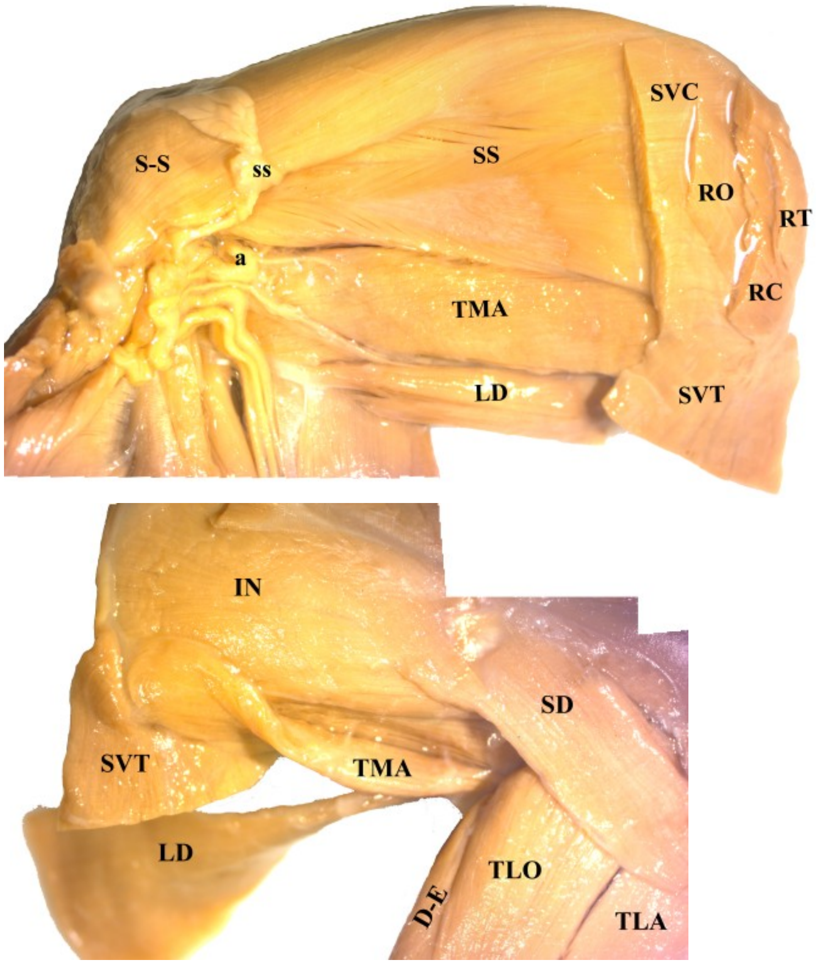


Figure 3.3B-6. M. subscapularis, with mm. latissimus dorsi and teres major reflected (P6113461).



A.

B.

Figure 3.3B-7. M. teres major.

A. Deep surface. B. Superficial surface.

[a- axillary nerve, D-E- dorso-epitrochlearis, IN- infraspinatus, LD- latissimus dorsi, RC- rhomboideus cervicis, RO- rhomboideus capitis, RT- rhomboideus thoracis, S-S- sternoscapulairs, SD- spinodeltoideus, ss- subscapular nerve, SS- subscapularis, SVC- serratus ventralis cervicis, SVT- serratus ventralis thoracis, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, TMA- teres major]

F. LATISSIMUS GROUP – THORACODORSAL NERVE

m. latissimus dorsi

M. latissimus dorsi has a 2 cm-long, tendinous origin along the spinous processes of four thoracic and lumbar vertebrae. The muscle is 8 mm wide, very thin, and overlapped by m. spinotrapezius. It fuses with the deep caudal edge of m. teres major, and gives origin to m. dorso-epitrochlearis. Immediately lateral to this the muscle becomes a 1 mm wide tendon, which remains distinct and somewhat separate from the teres major as the conjoined muscle travels deep to the brachial plexus to insert on a rugose line on the proximal end of the cranial-medial humerus.

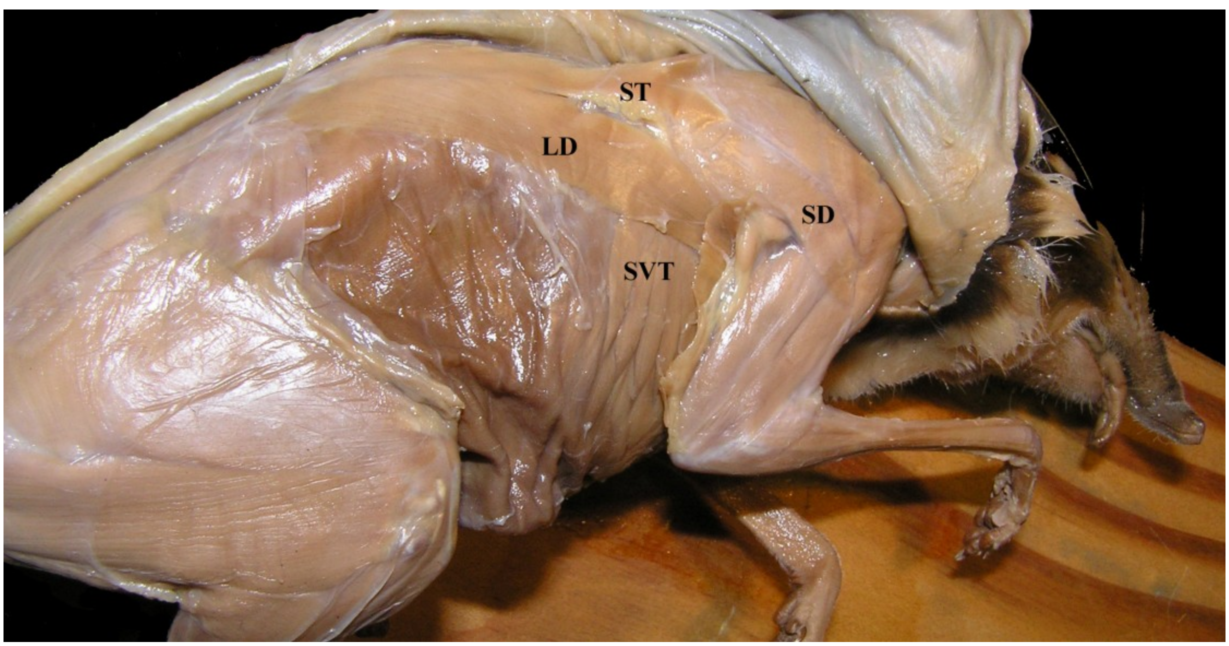


Figure 3.3B-8. M. latissimus dorsi (P7310084).

[LD- latissimus dorsi, SD- spinodeltoideus, ST- spinotrapezius, SVT- serratus ventralis thoracis]

G. PECTORALS GROUP – PECTORAL NERVES

mm. pectoralis superficialis, pectoralis profundus, pectoralis abdominalis, subclavius, sternoscapularis (=cleidoscapularis)

M. pectoralis superficialis has a 1.8 cm origin along the sternum. It is overlapped at its origin by m. sternomastoideus, and distally both reach the same point on the sternum. The muscle travels horizontally to its 7 mm long insertion on the medial deltopectoral crest deep to m. clavodeltoideus, just reaching midshaft.

M. pectoralis profundus is a thin sheet of muscle originating 2 cm distal to m. pectoralis superficialis along the ventral midline. The fibers are directed cranio-laterally, crossing diagonally to the fibers of m. pectoralis superficialis, and insert for 5 mm on the distal part of the greater tuberosity just lateral to the tendon of m. biceps brachii. A slip of m. panniculus carnosus inserts in association with the cranial edge of the insertion of m. pectoralis profundus, and spans the proximal tendon of m. biceps brachii.

M. pectoralis abdominalis originates from fascia overlying m. serratus ventralis thoracis. The muscle is broad but very thin and has two slightly different portions. The cranial portion is 7 mm wide and the caudal portion is 1.5 mm wide, and the two are distinguishable only because the muscle fibers of the caudal portion cross over the muscle fibers of the cranial portion. The two portions are fused and insert for 1 cm on the cranial aspect of the humerus just lateral to m. biceps brachii. The insertion is via a 4 mm wide translucent fascia, which covers the tendon of m. biceps brachii and appears to act somewhat like a bursa. The most proximal fibers of insertion form a 1 mm wide slip of muscle that spans m. biceps brachii and inserts on the surface of m. coracobrachialis.

A slip of m. panniculus carnosus inserts in connection with the cranialmost edge of the insertion of m. pectoralis abdominalis, as it did with m. pectoralis profundus.

M. subclavius originates from the first costal cartilage, deep to m. pectoralis superficialis. At 1.5 mm wide, it is quite a slender muscle. It passes inferior to the clavicle and inserts on the distal third of the deep surface of the lateral clavicle. Jullien (1967) observed some fibers leaving m. subclavius to insert on the acromion, which he believed to be a rudimentary "costo-scapularis"; I did not observe this in my specimen.

M. sternoscapularis (=cleidoscapularis) has a 1.1 cm origin along the cranial surface of the lateral half of the clavicle. It caps the shoulder and the cranial border of the scapula, covering the cranial edges of mm. supraspinatus and subscapularis. It inserts on the cranial edge of the acromion, on the fascia covering m. supraspinatus, and on the cranial border of the scapula near the cranial angle.

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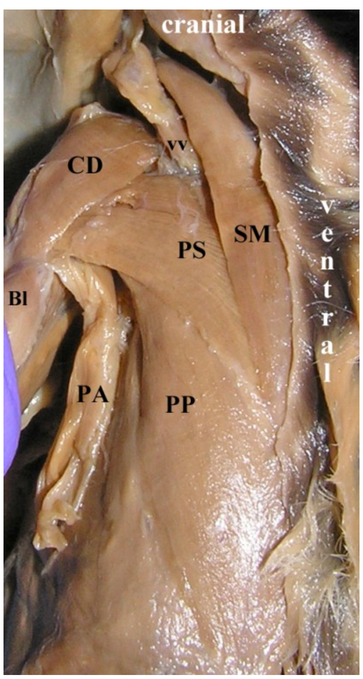

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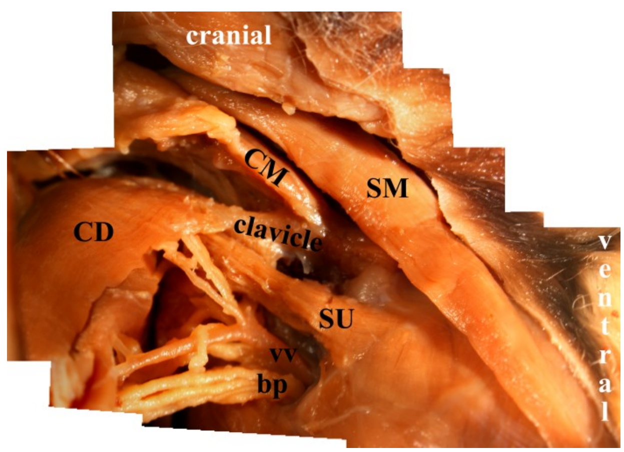
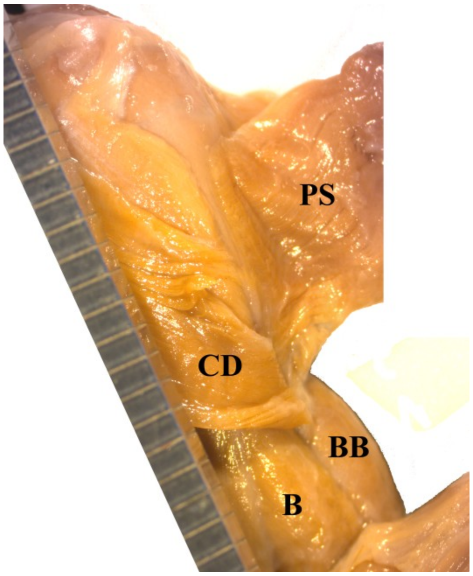


Figure 3.3B-9. Mm. pectoralis, ventral view.

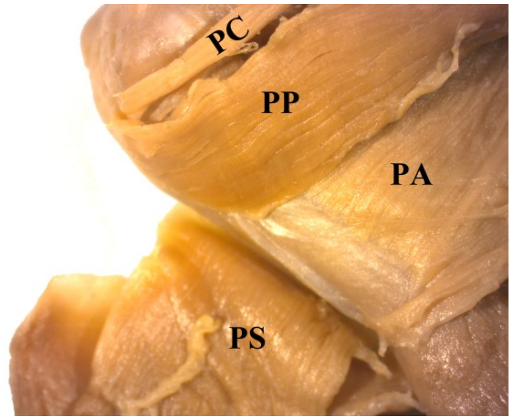
A. Superficial (P8050049). B. Deep.

** head of humerus to the upper left in all photographs

** lines on ruler are 1 mm



A.



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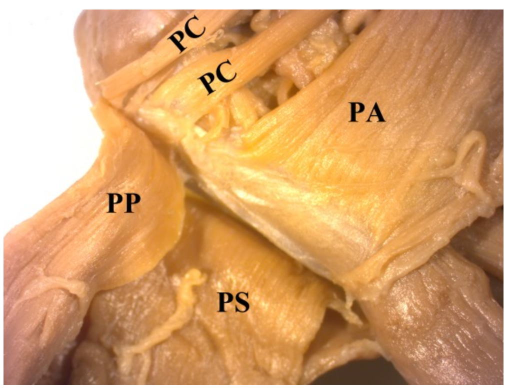

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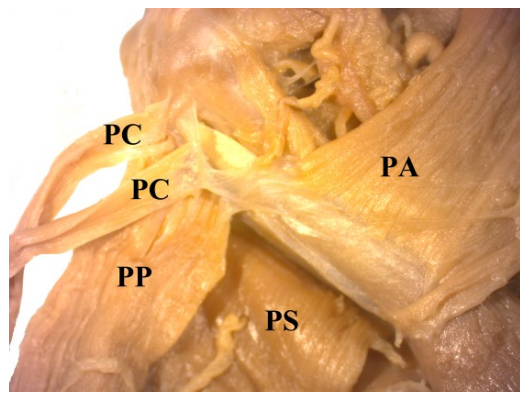

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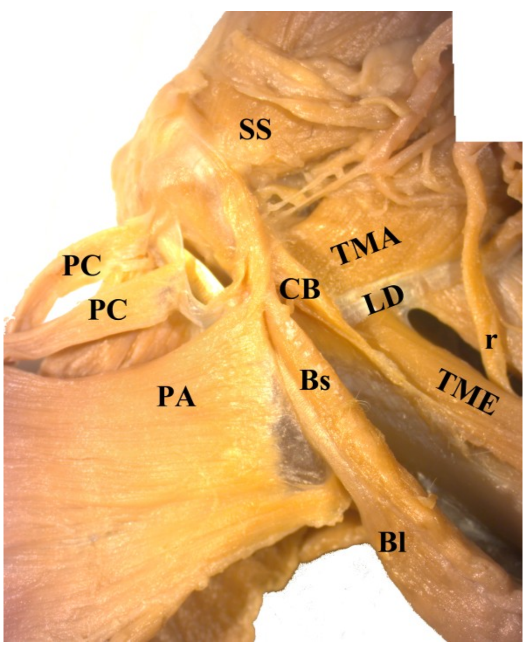


E.

Figure 3.3B-10. Mm. pectoralis inserting on the humerus.

A. M. clavodeltoideus reflected, showing insertion of m. pectoralis superficialis. B. Insertion of m. pectoralis profundus (S-155521-0037). C. M. pectoralis profundus reflected, showing insertion of two slips of m. panniculus carnosus (S-155456-0036). D. M. panniculus carnosus reflected, showing insertion of m. pectoralis abdominalis (S-155538-0038). E. M. pectoralis abdominalis reflected, showing bursa-like action of its fascia of insertion around m. biceps brachii.

H. BICEPS GROUP – MUSCULOCUTANEOUS NERVE

mm. coracobrachialis, biceps brachii, brachialis

M. coracobrachialis has a 3 mm wide origin from the medial side of the large tendon off the coracoid process. Emerging from deep to the lateral edge of this tendon is the musculocutaneous nerve. The muscle broadens to a 5 mm-wide insertion via thin tendinous fibers on the medial edge of the humeral shaft, beginning at the distal end of the insertion of m. latissimus dorsi and ending just above midshaft.

Mm. biceps brachii has two divisible bellies representing the short and long heads. Having two distinct bellies of mm. biceps brachii is unusual within mammals, and within Afrotheria. The short head of m. biceps brachii is the smaller and more medial, and has a 1.5 mm wide origin from the lateral side of the large tendon off the coracoid process. A small branch of the musculocutaneous nerve directly supplies the short head of m. biceps brachii whilst the rest of the nerve continues on to the deep surface of the long head of m. biceps brachii. Tendinous fibers from the tendon of origin continue on to cover the superficial and medial surfaces of the 2 cm-long and slender muscle belly. A few fibers of the short head of m. biceps brachii comingle with the long head, but for the most part the two bellies are easily separated. The distal tendon of the short head twists around the distal long head, and inserts deep to it and to m. brachialis on the caudo-medial neck of the radius.

The long head of m. biceps brachii originates via a long slender tendon from the supraglenoid tubercle. The tendon glides in the bicipital groove spanned by the insertion of mm. pectoralis, particularly m. pectoralis abdominalis, and slips of m. panniculus carnosus. The deep surface of the 5 mm-wide belly receives several branches of the musculocutaneous nerve. A short and flat distal tendon inserts into a fossa in the proximal ulna at the base of the coronoid process.

M. brachialis originates in a broad swath from the proximomedial aspect of the humerus on the ridge below the lesser tuberosity, where it is somewhat mingled with the origin of m. triceps brachii caput mediale, and around the caudal neck of the humerus to just below the greater tuberosity. There the muscle is deep to m. acromiodeltoideus and the origin of m. triceps brachii caput laterale. The muscle crosses from the lateral side of the arm to the medial forearm, to insert deep to the long head of biceps brachii on the medial aspect of the ulna.

I. SPINATI GROUP – SUPRASCAPULAR NERVE

mm. supraspinatus, infraspinatus

M. supraspinatus fills the entire supraspinous fossa, and also takes origin from the cranial edge of the scapular spine, the cranial border of the scapula and the deep surface of the cranial edge of m. subscapularis. It inserts via a very robust tendon onto the cranial and medial surfaces of the greater tuberosity of the humerus.

M. infraspinatus fills the entire infraspinous fossa, and also takes origin from the dorsal edge of the metacromion, the caudal surface of the scapular spine, and from the center of the caudal border of the scapula. The muscle has a central tendon which appears at about the middle of the infraspinous fossa and becomes quite thick by its insertion on the lateral surface of the greater tuberosity.

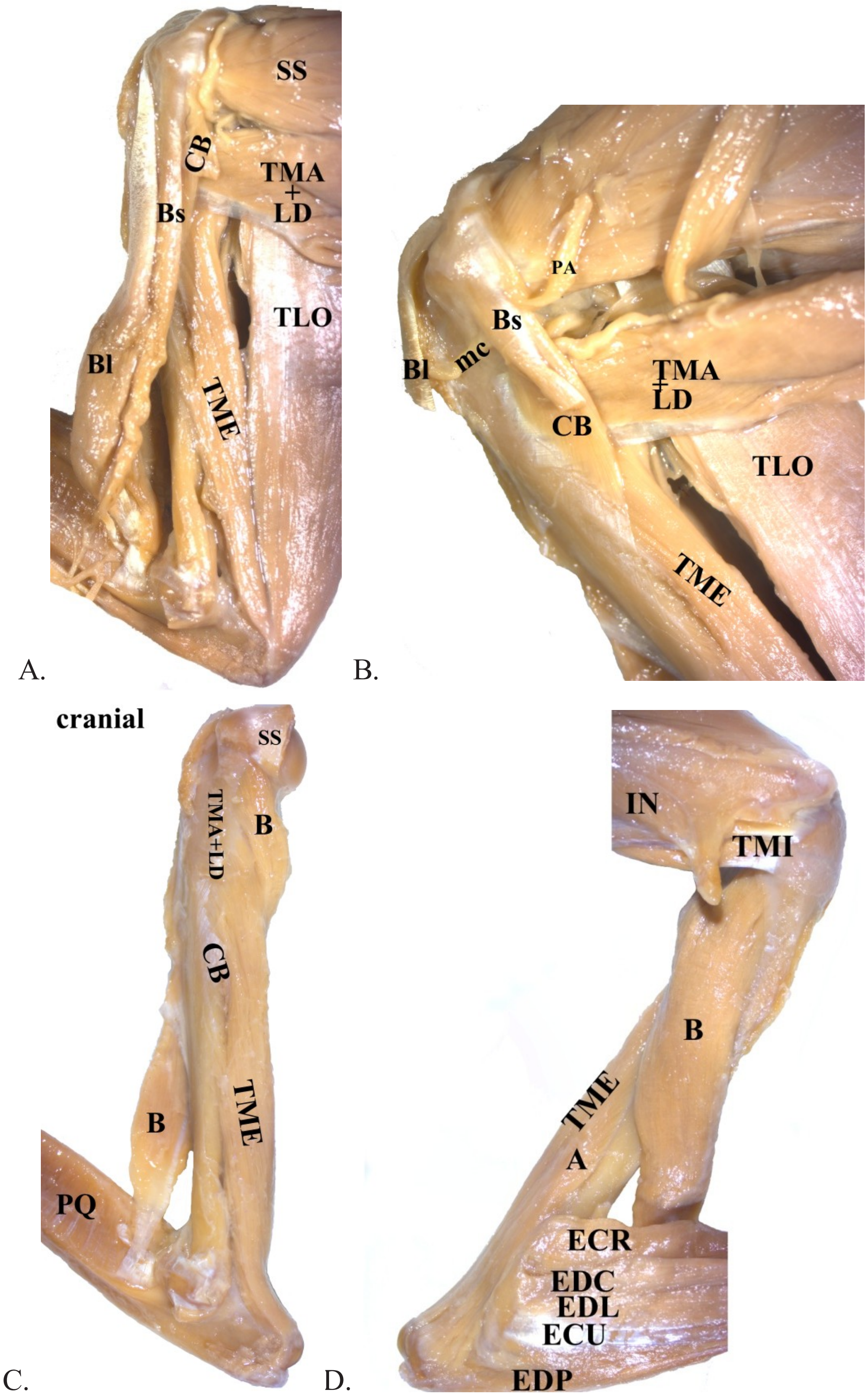


Figure 3.3B-11. Muscles of the biceps group.

A. Medial view. B. M. coracobrachialis medial view, with mm. biceps brachii removed.

C. M. brachialis, medial view, with mm. biceps brachii and coracobrachialis removed.

D. M. brachialis, lateral view.

J. TRICEPS GROUP – RADIAL NERVE

mm. dorso-epitrochlearis, triceps brachii (caput laterale, caput mediale, caput longum), anconeus

M. dorso-epitrochlearis originates from the point of fusion of mm. latissimus dorsi and teres major. This is unusual within mammals, as typically the muscle takes origin from m. latissimus dorsi only. It is a 5 mm wide band of muscle fibers that travels down the medial arm to insert on the medial aspect of the olecranon.

In *Petrodromus*, there are four heads of mm. triceps brachii, as there is an additional portion of m. triceps brachii caput longum. M. triceps brachii caput longum superficialis originates via fleshy fibers for 1 cm along a ridge on the caudal border of the scapula, deep to the origin of m. teres minor. The muscle is fused with m. triceps brachii caput longum profundus and also with m. triceps brachii caput laterale 2 mm proximal to insertion on the olecranon. M. triceps brachii caput longum profundus originates via a 3 mm-wide tough and shiny tendon from a fossa on the ventral side of the neck of the scapula. From the medial side of the arm, m. triceps brachii caput longum superficialis is visible along its medial edge and separated from m. triceps brachii caput longum profundus by a large muscular branch of the radial nerve. From the lateral side of the arm, m. triceps brachii caput longum profundus is not visible at origin, but sweeps around to cover and fuse with the caudal surface of m. triceps brachii caput longum superficialis 1.5 cm from its origin. After fusion, their deep surface has a thick tendon containing a sesamoid that glides in the groove at the tip of the olecranon process. Such a sesamoid, the patella cubiti, is a rare anomaly in humans (Sykes, 1963). The tendon inserts on the caudal and medial surfaces of the olecranon.

M. triceps brachii caput laterale originates via thin tendinous fibers from the lateral aspect of the humerus deep to the insertions of mm. teres minor and spinodeltoideus, ending at about the midpoint of the deltopectoral crest. Proximally, m. brachialis is visible deep to the medial edge of the muscle; distally it can be seen deep to the lateral edge of the muscle. It fuses with m. triceps brachii caput longum superficialis and inserts on the caudo-lateral edge of the olecranon and proximal ulna.

M. triceps brachii caput mediale originates via fleshy fibers from almost the entire caudo-medial surface of the humerus. Proximally, it is hidden by the tendinous insertions of mm. latissimus dorsi, teres major, and coracobrachialis. The muscle belly is separated from mm. triceps brachii caput longum proximally by the axillary nerve and distally by the radial nerve. It inserts on the medial half of the cranial surface of the olecranon.

M. anconeus is slight and quite fused with m. triceps brachii caput mediale. It originates in the fascia over the caudal surface of the lateral epicondyle of the humerus and insert on the lateral half of the cranial surface of the olecranon.

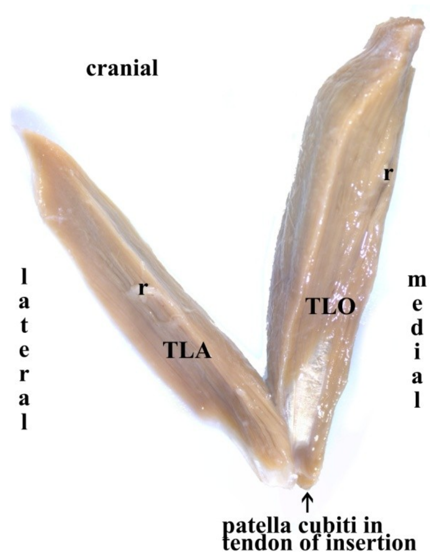


Figure 3.3B-12. Patella cubiti in tendon of insertion of mm. triceps brachii caput longum et laterale, deep surface.

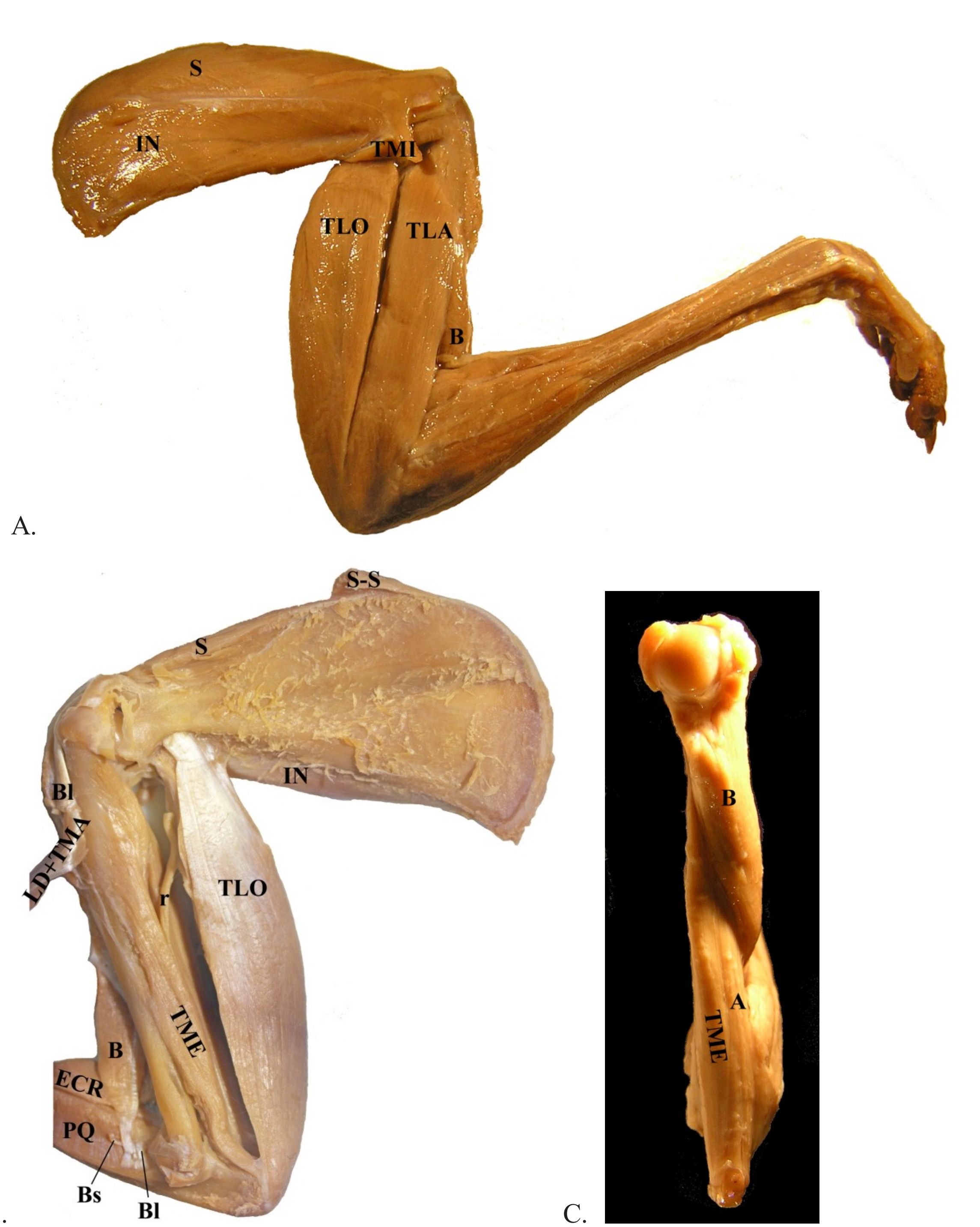


Figure 3.3B-13. Mm. triceps brachii.
A. Lateral view (P6113459). B. Medial view. C. Deep caudal view (P6183498).

[A- anconeus, B- brachialis, Bl- biceps brachii long head, Bs, biceps brachii short head, ECR- extensor carpi radialis, IN-infraspinatus, LD+TMA- latissimus dorsi and teres major, PQ- pronator quadratus, r- radial nerve, S- supraspinatus, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, TME- triceps brachii caput mediale]

K. EXTENSOR GROUP – RADIALNERVE

mm. brachioradialis, extensors carpi radialis longus et brevis, extensor digitorum communis, extensor digitorum lateralis, extensor carpi ulnaris, supinator, abductor pollicis longus, extensor digitorum profundus

M. brachioradialis is absent.

M. extensor carpi radialis longus is 3.5 mm wide where it originates from the lateral supracondylar ridge of the humerus. It is fleshy for 1.5 cm, whereupon it fuses with the deeper m. extensor carpi radialis brevis, which originates from m. extensor digitorum communis and the lateral epicondyle of the humerus. The fused mm. extensor carpi radialis longus et brevis lies deep to the superficial radial nerve and then passes deep to the abductor pollicis longus. It inserts on the base of metacarpal III, with a small slip to the base of metacarpal II.

M. extensor digitorum communis originates from the distal lateral supracondylar ridge and fuses to some extent with mm. extensor carpi radialis brevis and extensor digitorum profundus. The muscle is fleshy and 1.5 mm wide at origin, becoming a tendon after 1.5 cm. It splits into four tendons, which pass under the retinaculum at the carpus. The tendons form extensor expansions that insert on the lateral side of digit II, the center of digit III, and the medial sides of digits IV and V. Jullien (1967) stated that, in the macroscelidines, there are initially only three tendons until the most medial tendon splits into two tendons.

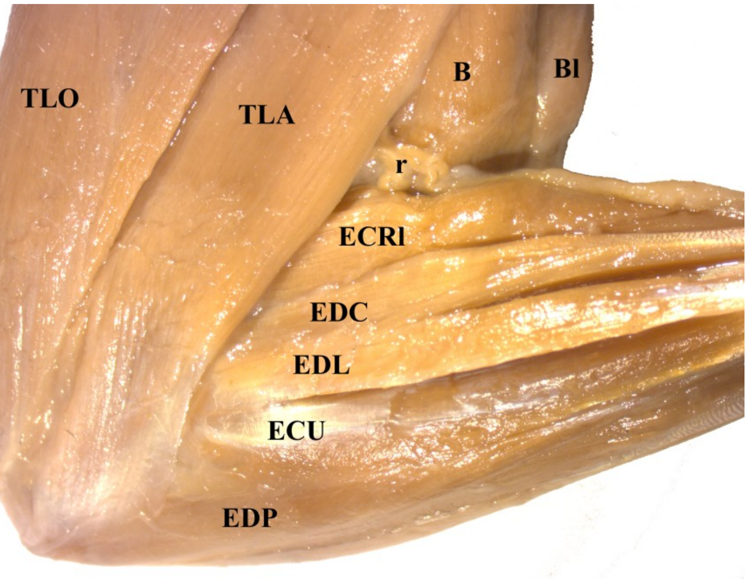
M. extensor digitorum lateralis has a mostly fleshy origin from the caudal surface of m. extensor digitorum communis. This muscle appears to be two bellies, which are mostly fused proximally but split into two tendons at the 1.5 cm mark. The more medial and slightly slimmer tendon crosses deep to m. extensor digitorum communis tendon to digit V, and inserts on the lateral side of digit IV. The more lateral tendon expands greatly and inserts on the lateral side of digit V.

M. extensor carpi ulnaris originates via tendinous fibers from the lip of the fossa on the lateral epicondyle, and also via fleshy fibers from the origin of m. extensor digitorum profundus on the ulna. The muscle belly is 2.5 mm wide and becomes fully tendinous at 1.5 cm. The tendon travels in a groove on the caudo-lateral surface of the radius, crosses deep to the retinaculum, and inserts on the base of metacarpal V.

M. supinator is very deep, originating from the lateral epicondyle via a tendon that is connected to the ligament joining the lateral epicondyle and the radius. It inserts on the cranial aspect of the radius.

M. abductor pollicis longus is a deep, pinnate muscle which originates from the lateral radius and ulna. It becomes a broad, flat tendon that crosses the forearm, passes superficial to m. extensor carpi radialis, and through a groove on the distal radius, to insert on the base of metacarpal I.

M. extensor digitorum profundus originates from the caudo-lateral edge of the proximal ulna. The tendon crosses the forearm cranially to travel lateral to the tendon of m. abductor pollicis longus. It inserts on the medial side of digit II.



A.

B.

Figure 3.3B-14. Muscles originating from the lateral epicondyle, lateral view.

A. Elbow only. B. Entire arm, forearm, and manus, lateral view. Note length of tendons.

[AD- acromiodeltoideus, B- brachialis, Bl- biceps brachii long head, CD- clavodeltoideus, ECRl- extensor carpi radialis longus, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, EDP- extensor digitorum profundus, r- radial nerve, SD- spinodeltoideus, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum]

Figure 3.3B-15. M. extensor digitorum profundus, lateral view.

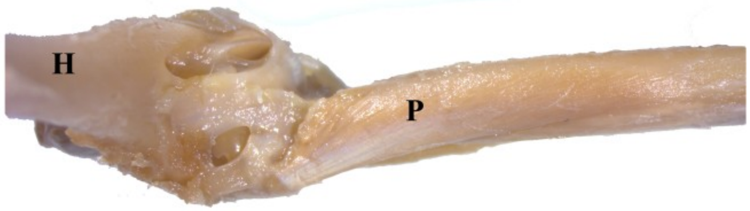
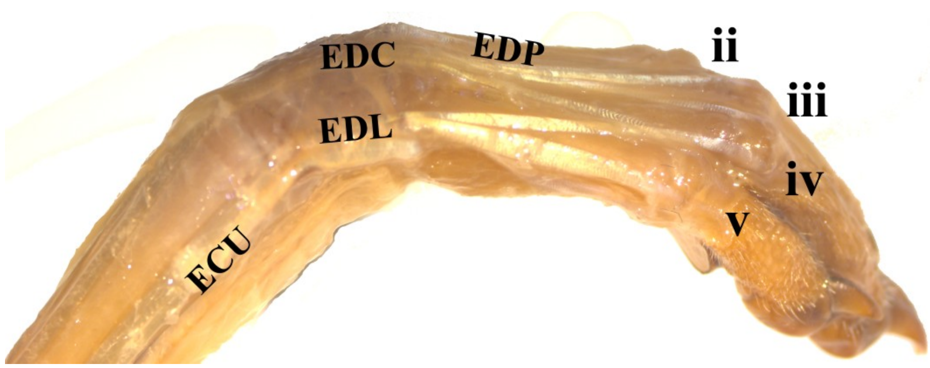


Figure 3.3B-16. M. supinator, viewed from cranial aspect of the cubital fossa.

A.



B.

Figure 3.3B-17. Extensor tendons in the manus.

A. Dorsal view. B. Lateral view.

[A- anconeus, APL- abductor pollicis longus, B- brachialis, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL, extensor digitorum lateralis, EDP- extensor digitorum profundus, H- humerus, P- supinator]

L. FLEXOR GROUP – MEDIAN and ULNAR NERVES

pronator teres^{m}, flexor carpi radialis^{m}, palmaris longus^{u}, flexor digitorum superficialis^{m}, flexor digitorum profundus^{m+u}, lumbricales^{m+u}, flexor carpi ulnaris^{u}, epitrochleo-anconeus^{u}, pronator quadratus^{m}

M. pronator teres has the most proximal origin of the flexors, about 1 mm wide from the medial epicondyle. On its deep surface is a shiny, flat tendon, but superficially the muscle is fleshy. A similar flat tendon appears on its superficial surface, and after about 2 cm the entire muscle becomes a shiny, flat tendon. It inserts on the cranial surface of the radius, ending at about midshaft deep to the tendon of m. extensor carpi radialis.

M. flexor carpi radialis has a thicker muscle belly than m. pronator teres and originates just inferior to it on the medial epicondyle. After 1.4 cm, the muscle becomes a tendon which is strongly attached to the radius by fascia and tendinous fibers. There is a connection between the tendon of m. pronator teres and those fibers keeping m. flexor carpi radialis applied to the radius. The tendon skirts just lateral to the pollex and dives deep through a ligamentous tunnel across the carpus to the deep palm. It inserts on the palmar surface of the base of metacarpal II.

The origin of m. flexor digitorum superficialis is not actually superficial. It originates from the caudal surface of the medial epicondyle of the humerus with the deep epicondylar belly of m. flexor digitorum profundus. Their conjoined tendon slides in the groove on the distal medial epicondyle. The muscle belly is fleshy for 2.5 cm, and then becomes tendinous and divides into three tendons. These three tendons remain superficial through the carpus and into the manus. Each tendon is perforated by the tendon for m. flexor digitorum profundus and inserts on the sides of the middle phalanges of digits II-IV.

M. palmaris longus originates mostly from the humeral belly of m. flexor carpi ulnaris and also from the superficial epicondylar belly of m. flexor digitorum profundus. The muscle belly is only 1 cm long and soon becomes a slender tendon, which covers the tendon of m. flexor carpi ulnaris The distal end was damaged during skinning at the superficial palmar aponeurosis, making it impossible to determine a more detailed insertion. Jullien (1967) reported that the tendon goes to the distal ends of metacarpals II and V.

The median nerve travels through the entepicondylar foramen with the brachial artery. It sends branches to all the muscles originating from the medial epicondyle. Distally, the nerve becomes the anterior interosseous and travels with the anterior interosseous artery on the surface of m. pronator quadratus.

M. flexor digitorum profundus is comprised of two bellies from the epicondyle, both receiving median nerve innervation, and one belly from the ulna, which receives ulnar nerve innervation.

The superficial epicondylar belly of m. flexor digitorum profundus (FDPe) originates from the medial epicondyle between the origin of m. flexor carpi radialis and the humeral origin of m. flexor carpi ulnaris. It gives partial origin to m. palmaris longus. After 1.5 cm, the muscle becomes a flat tendon which is less than 1 mm wide. It joins with the conjoined flexor tendon at the carpus.

The deep epicondylar belly of m. flexor digitorum profundus (FDPd) originates with m. flexor digitorum superficialis from the caudal surface of the medial epicondyle. The belly is fleshy for only 1 cm and becomes a long thin tendon which remains separate from there to the carpus, where it inserts on the medial-most edge of the conjoined flexor tendon.

The ulnar portion of m. flexor digitorum profundus originates along the caudal and medial surfaces of the ulna, from the olecranon to midshaft, and also from the surface of m. pronator quadratus muscle. The muscle mass has a superficial tendon which splits into four imperfectly separated tendons, while the deep surface remains fleshy almost to the carpus. This makes it unlike any of the other flexor or extensor forearm muscles, all of which have long tendons making up about half their length.

The tendons of all three portions of m. flexor digitorum profundus fuse just proximal to the carpus. The resulting large conjoined tendon sends a small tendon that inserts on the distal phalanx of the pollex, while the bulk of the tendon splits into four robust tendons for digits II-V. The tendons for digits II-IV perforate through the tendons of m. flexor digitorum superficialis, and then go on to insert on the distal phalanx. The tendons for digits I and V do not have an associated tendon of m. flexor digitorum superficialis.

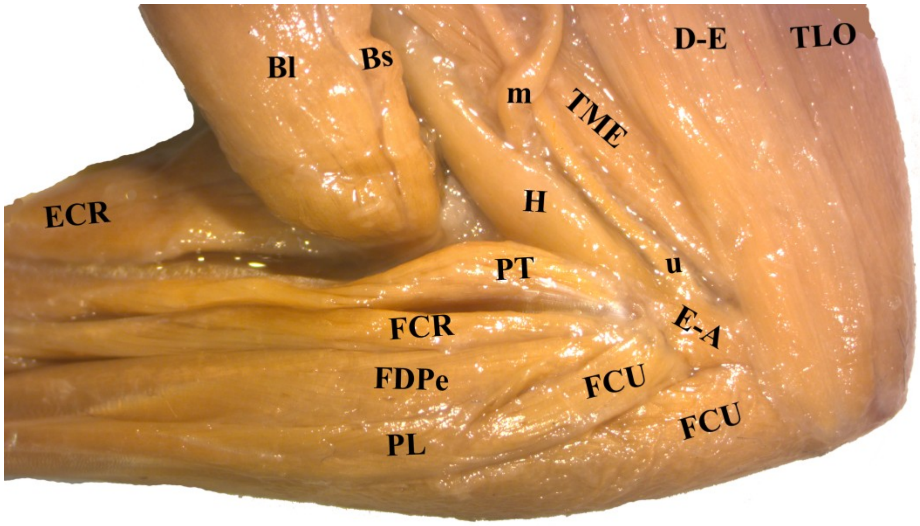
There are four mm. lumbricales serving digits II-V. Each originates from the medial side of a tendon of m. flexor digitorum profundus and inserts on the medial side of the base of the proximal phalanx for its respective digit. Mm. lumbricales to digits II, III, and IV receive median nerve innervation, and m. lumbrical to digit V receives ulnar nerve innervation.

M. flexor carpi ulnaris has two heads of origin. The epicondylar belly has a robust 2 mm origin from the medial epicondyle. The ulnar nerve pierces through the first few fibers to travel on the deep surface of the muscle belly. After only 1 cm the muscle is completely fused with the ulnar head, which originates from the olecranon distal to the insertions of mm. epitrochleo-anconeus and dorso-epitrochlearis. The two conjoined heads are fleshy for 2 cm and then form a flat tendon. It inserts as a stout tendon on the pisiform.

M. epitrochleo-anconeus originates from the caudal surface of the medial epicondyle, covers the ulnar nerve as it passes behind the medial epicondyle, and inserts into the medial olecranon and ulnar head of m. flexor carpi ulnaris, splitting the muscle where the ulnar nerve travels through it.

The ulnar nerve travels deep to m. epitrochleo-anconeus. When mm. epitrochleo-anconeus and flexor carpi ulnaris are reflected, a branch to the ulnar head of m. flexor digitorum profundus is visible. Then it travels along the deep lateral surface of m. flexor carpi ulnaris tendon to reach the deep muscles of the manus. There is also a superficial branch innervating m. abductor digiti minimi and providing sensory innervation to the lateral side of the manus.

Despite the fusion of the radius and ulna, m. pronator quadratus is a robust muscle 1 cm long and 3 mm wide spanning the proximal third of the fused bones. It terminates just proximal to the beginning of the insertion of m. pronator teres. The muscle is tendinous on the ulnar side and fleshy on the radial side.



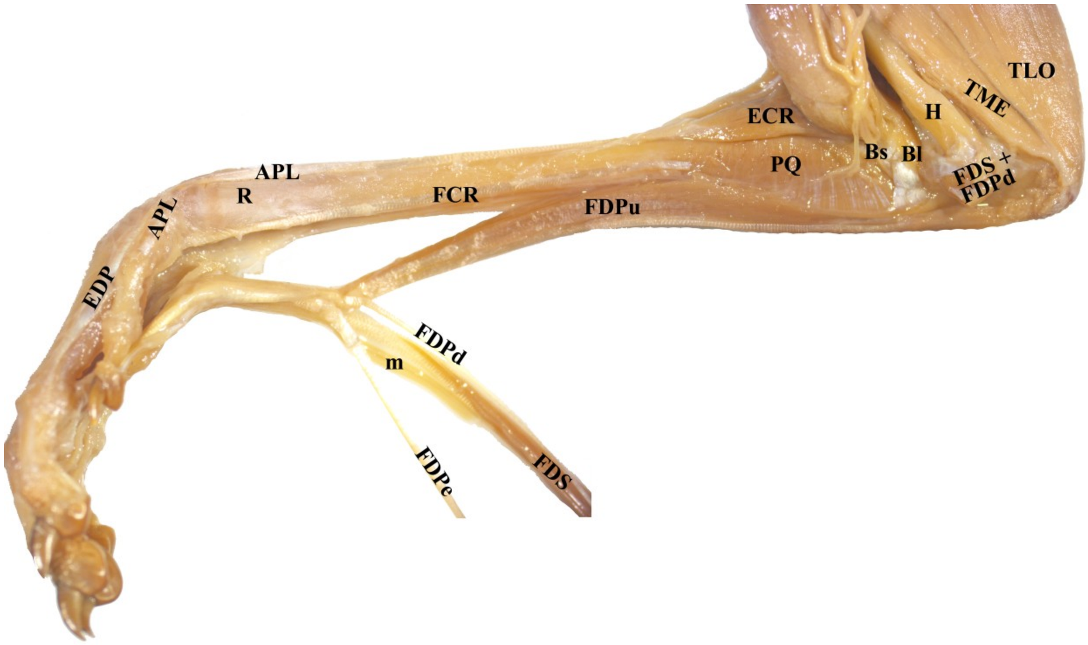
A.

B.

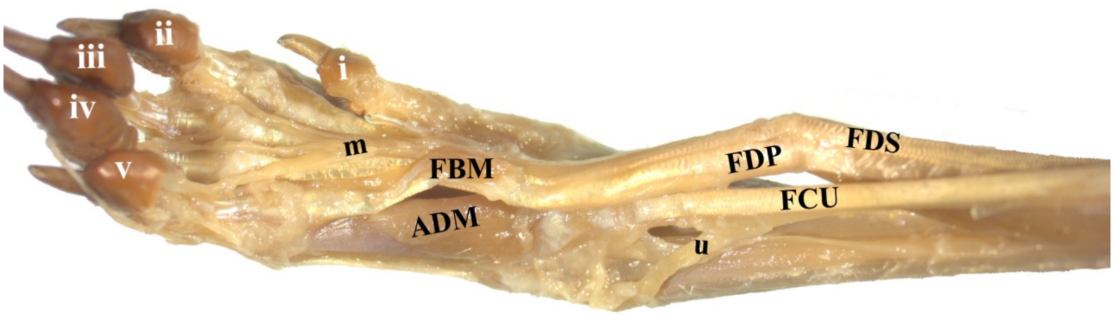
Figure 3.3B-18. Muscles originating from the medial epicondyle, medial view.

A. Elbow only. B. Entire forearm and manus, lateral view. Note length of tendons.

[Bl- biceps brachii long head, Bs- biceps brachii short head, D-E- dorso-epitrochlearis, E-A- epitrochleo-anconeus, APL- abductor pollicis longus, ECR- extensor carpi radialis, EDP- extensor digitorum profundus, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, FDS- flexor digitorum superficialis, FDPe- superficial epicondylar head of flexor digitorum profundus, H- humerus, m- median nerve, PL- palmaris longus, PT- pronator teres, TLO- triceps brachii caput longum, TME- triceps brachii caput mediale, u- ulnar nerve]



A.



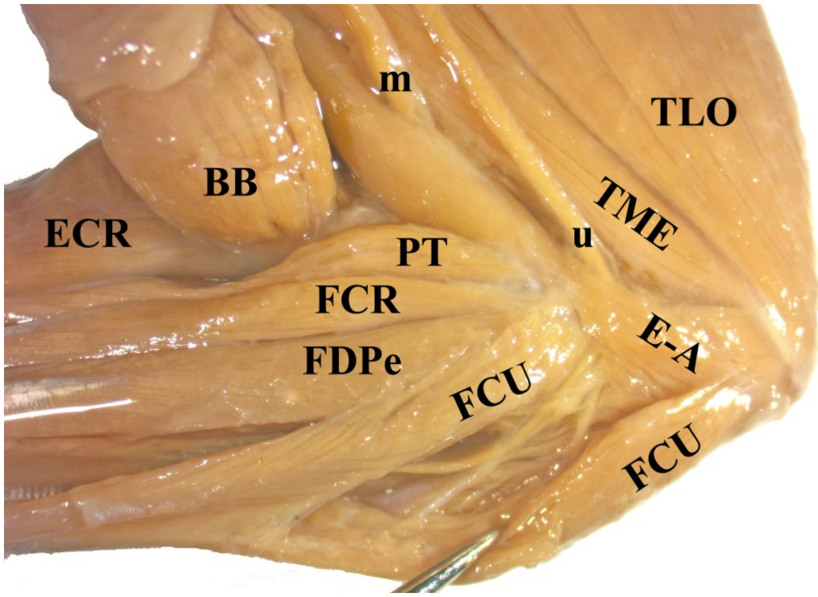
B.

C.

Figure 3.3B-19. Mm. flexor digitorum superficialis and flexor digitorum profundus.

A. Medial view. B. Tendons across the carpus. C. Tendon of m. flexor digitorum superficialis (left, probe) perforated by tendon of m. flexor digitorum profundus (right, forceps) (S-160701-0032).

A.



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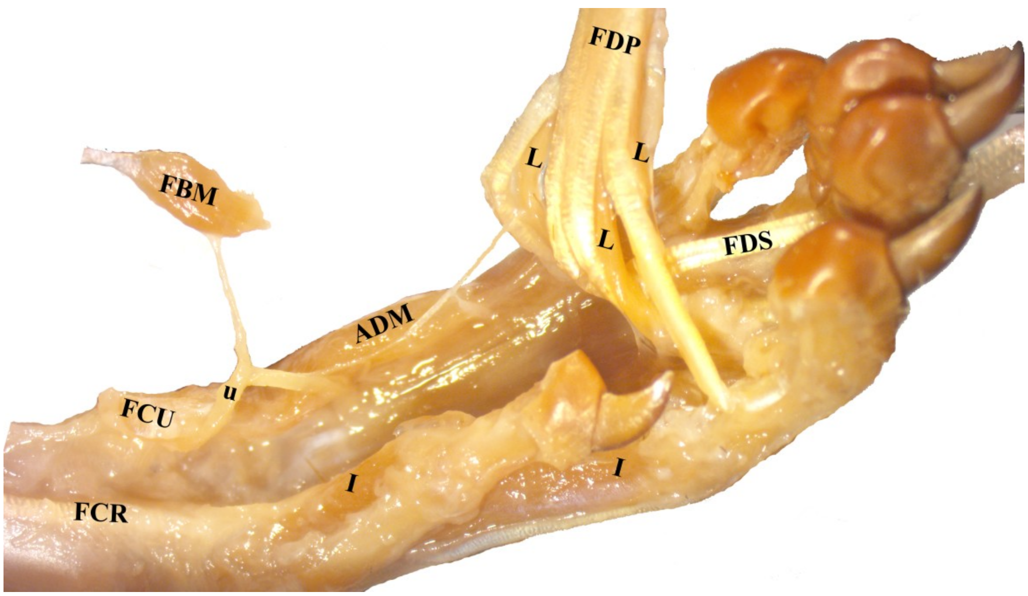


Figure 3.3B-20. Ulnar nerve in forearm and manus. A. M. epitrochleo-anconeus spanning ulnar nerve (S-150457-0003). B. Ulnar nerve in the manus.

[ADM- abductor digiti minimi, Bl- biceps brachii long head, Bs- biceps brachii short head, APL- abductor pollicis longus, ECR- extensor carpi radialis, EDP- extensor digitorum profundus, FBM- flexor digitorum brevis manus, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, FDS- flexor digitorum superficialis, FDPd- deep epicondylar head of flexor digitorum profundus, FDPe- superficial epicondylar head of flexor digitorum profundus, FDPu- ulnar head of flexor digitorum profundus, H- humerus, m- median nerve, PQ- pronator quadratus, R- radius, TLO- triceps brachii caput longum, TME- triceps brachii caput mediale, u- ulnar nerve]

M. MANUS GROUP – MEDIAN and ULNAR NERVES

palmaris brevis, flexor digitorum breves manus[u], abductor digiti minimi[u], contrahentes, abductor pollicis brevis, flexor digitorum breves profundus[u]

M. palmaris brevis is absent in *Petrodromus.*

M. flexor digitorum brevis manus originates from fascia superficial to the pisiform. It inserts via a tiny tendon onto the retinaculum surrounding the metacarpophalangeal joint of digit 5. The tendons of mm. flexor digitorum superficialis and flexor digitorum profundus pass deep. It receives ulnar nerve innervation.

M. abductor digiti minimi is the largest muscle in the manus. It originates from the pisiform and the tendon of m. flexor carpi ulnaris. It inserts onto the lateral side of the metacarpal for digit V. M. abductor pollicis brevis is absent in *Petrodromus*. Jullien (1967) reported m. abductor pollicis brevis between the trapezius and medial side of the proximal phalanx of the pollex in *Petrodromus*, but claims there is only one interosseous (= flexor digitorum brevis profundus) for that digit.

There are three mm. contrahentes in the manus. They originate from the ligaments of the carpus and insert on the lateral side of the proximal phalanges of digits I and II and the medial side of the proximal phalanx of digit V. M. contrahens for the thumb (=adductor pollicis) is very delicate.

Mm. flexor digitorum breves profundus are ten in number, one pair for each metacarpal. They originate from the carpus deep to mm. contrahentes and insert on the sides of the base of the proximal phalanx for each digit, at the base of the flexor sheath.

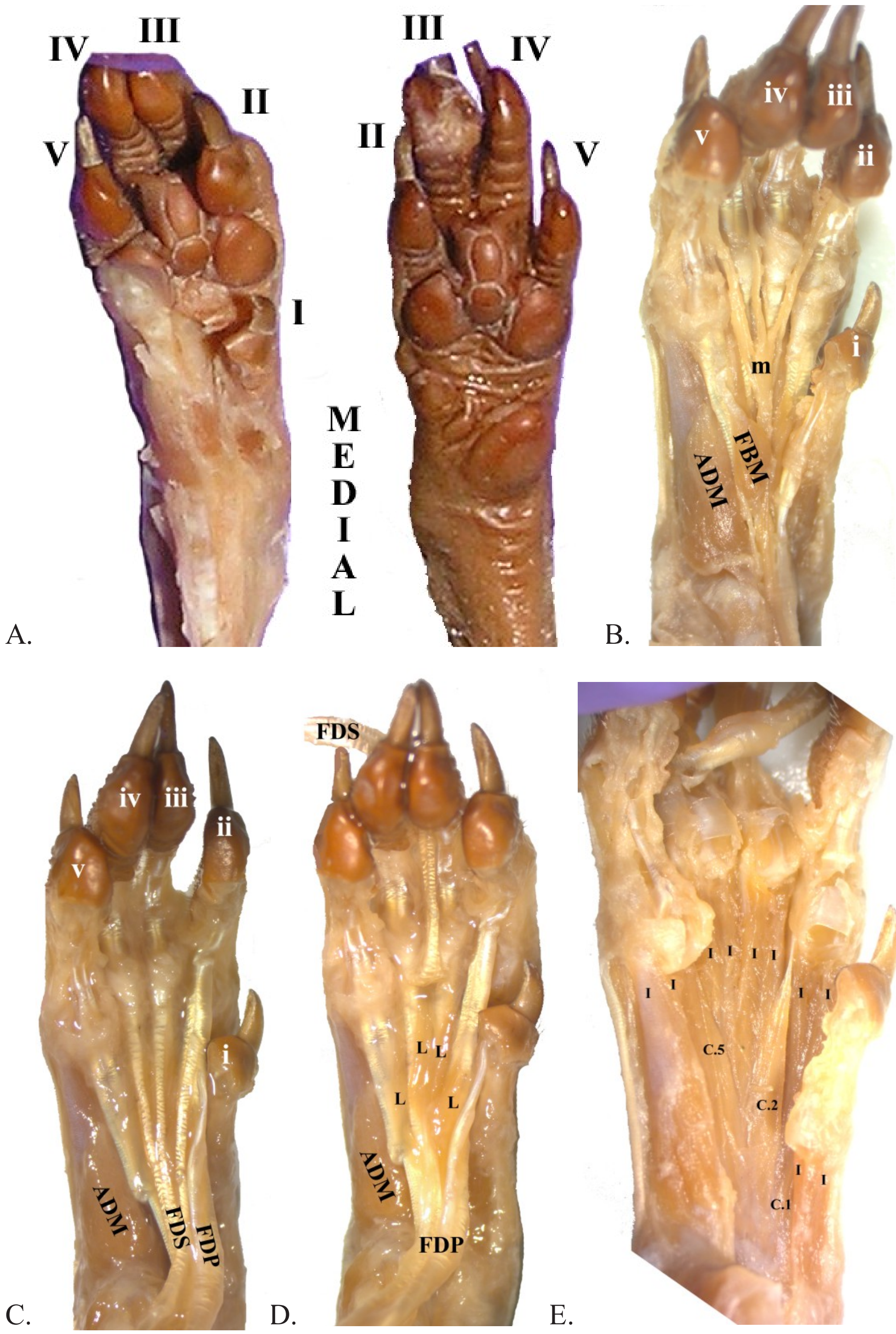
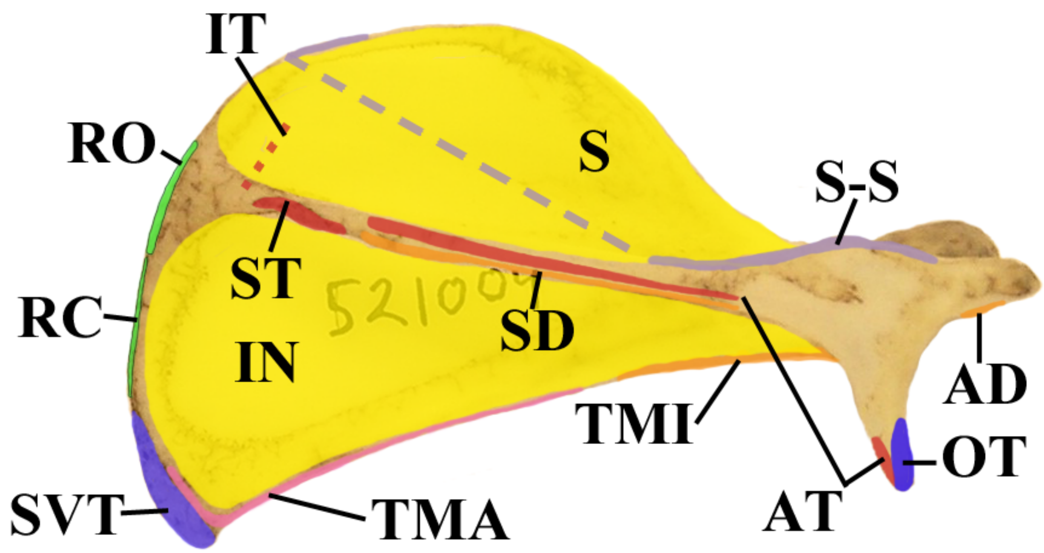
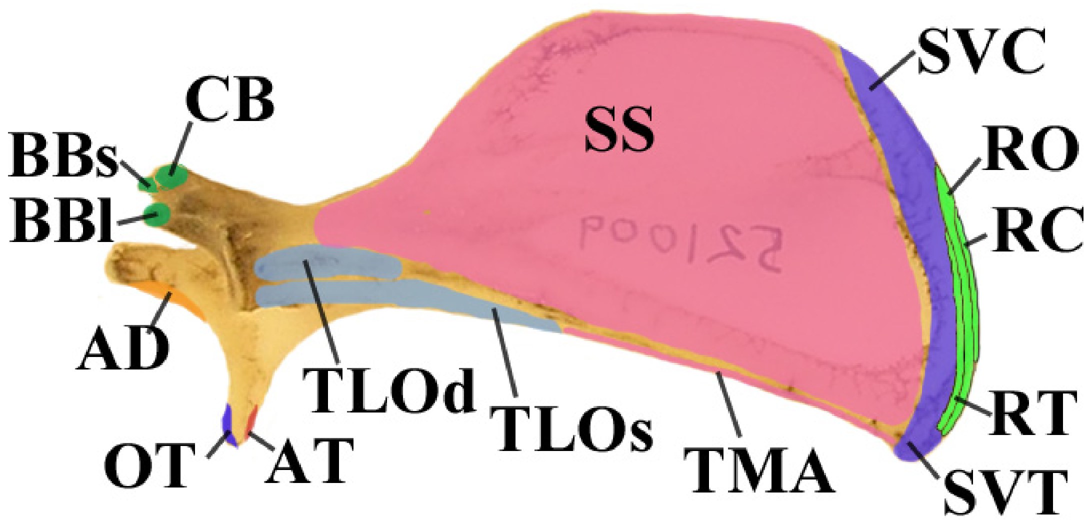


Figure 3.3B-21. Muscles of the manus.

A. Right manus partially skinned with five digits, left manus with four digits. B. M. flexor digitorum breves manus and median nerve (S-152732-0007). C. M. flexor digitorum superficialis. D. Mm. flexor digitorum profundus and lumbricales. E. Mm. contrahentes and flexor digitorum breves profundus.



A.



B.

Figure 3.3B-22. Muscle attachment maps for the scapula.
A. Superficial surface of the scapula. B. Deep surface of the scapula.

[AD- acromiodeltoideus, AT- acromiotrapezius, BBl – glenoid (long) head of biceps brachii, BBs – coracoid (short) head of biceps brachii, CB- coracobrachialis, IN- infraspinatus, OT – omotransversarius, RC- rhomboideus cervicis, RO- rhomboideus capitis, RT- rhomboideus thoracis, S- supraspinatus, S-S- sternoscapularis, SS – subscapularis, ST – spinotrapezius, SVC- serratus ventralis cervicis, SVT- serratus ventralis thoracis, TLOd – triceps brachii caput longum profundus, TLOs - triceps brachii caput longum superficialis, TMA – teres major, TMI – teres minor]

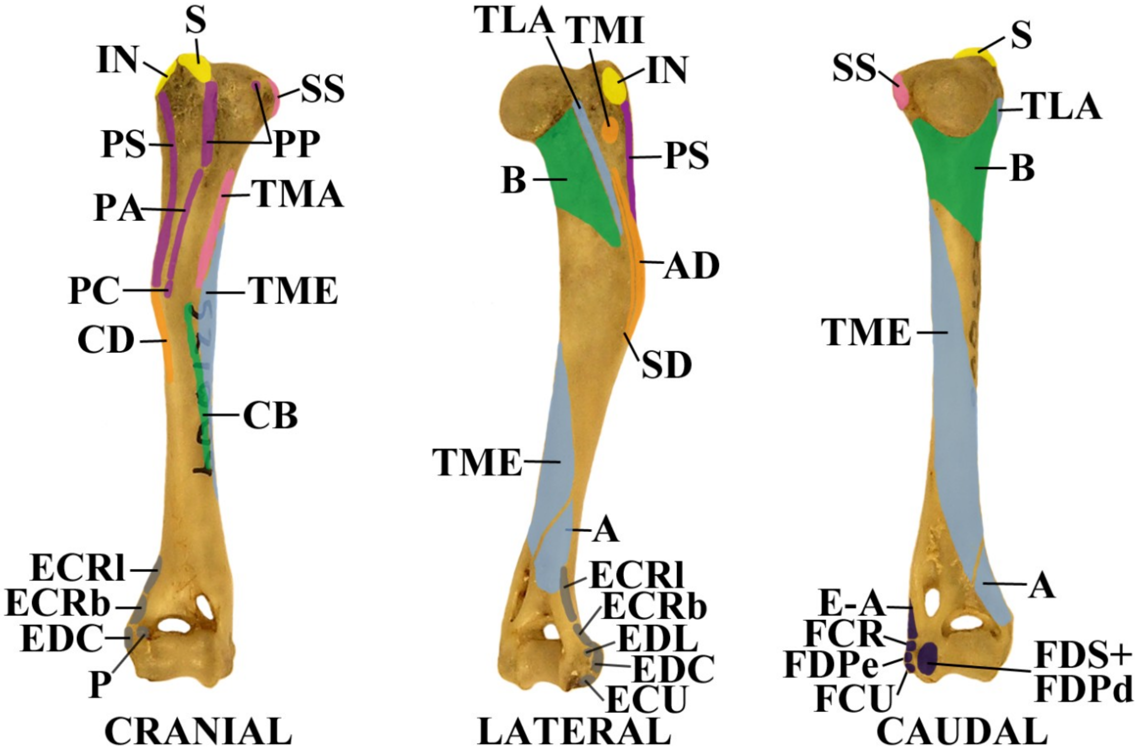


Figure 3.3B-23. Muscle attachment maps for the humerus.

[A- anconeus, AD- acromiodeltoideus, B- brachialis, CB- coracobrachialis, E-A- epitrochleo-anconeus, ECRb- extensor carpi radialis brevis, ECRl – extensor carpi radialis longus, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, FCR- flexor carpi radialis, FDPe- superficial portion of flexor digitorum profundus, FDPd- deep portion of flexor digitorum profundus, FDS – flexor digitorum superficialis, IN- infraspinatus, LD- latissimus dorsi, PA- pectoralis abdominalis, PC- panniculus carnosus, PP - pectoralis profundus, PS- pectoralis superficialis, PT- pronator teres, S- supraspinatus, SD- spinodeltoideus, SS- subscapularis, TLA- triceps brachii caput laterale, TMA- teres major, TME- triceps brachii caput mediale, TMI- teres minor]

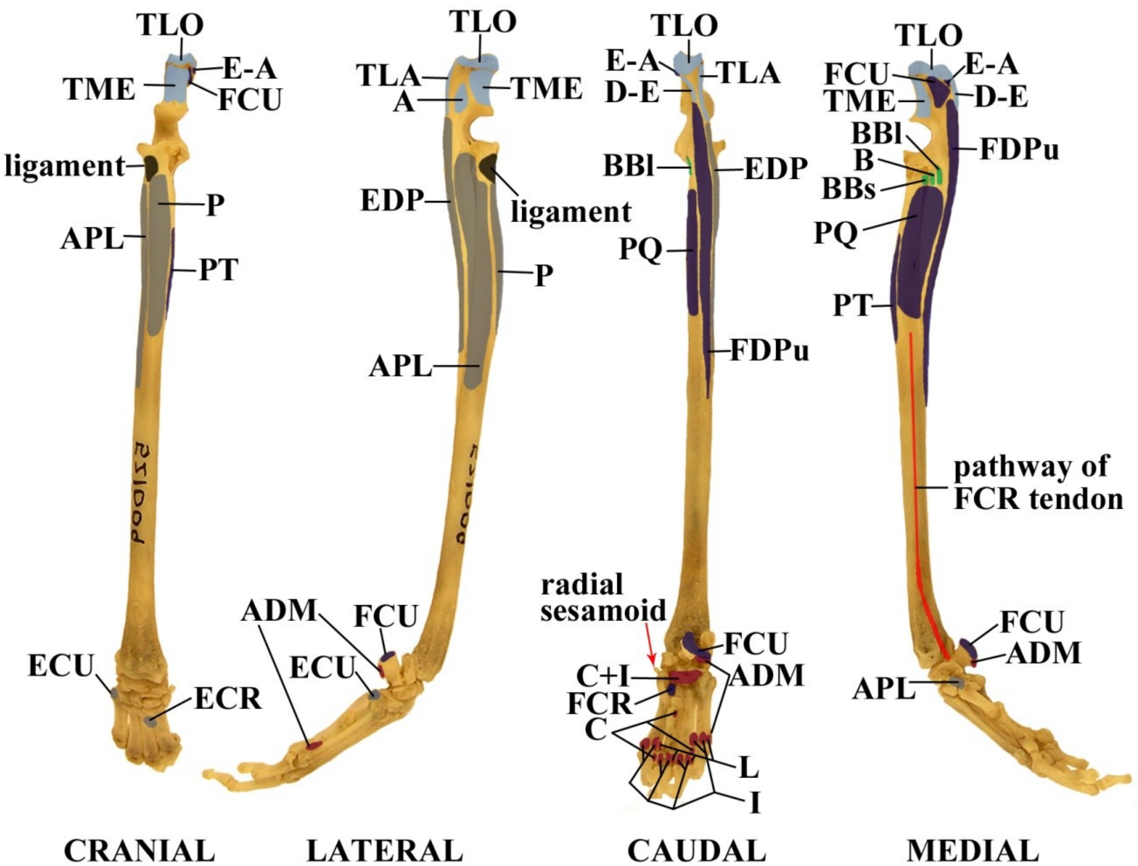


Figure 3.3B-24. Muscle attachment maps for the radius, ulna, and manus.

[A – anconeus, ADM – abductor digiti minimi, APL – abductor pollicis longus, B – brachialis, BBl – long head of biceps brachii, BBs – short head of biceps brachii, C – contrahentes, D-E – dorso-epitrochlearis, E-A – epitrochleo-anconeus, ECR – extensor carpi radialis, ECU – extensor carpi ulnaris, EDP – extensor digitorum profundus, FCR – flexor carpi radialis, FCU – flexor carpi ulnaris, FDPu – ulnar head of flexor digitorum profundus, I – flexor digitorum breves profundus, L – lumbricales, P – supinator, PT – pronator teres, PQ – pronator quadratus, TLA – triceps brachii caput laterale, TLO – triceps brachii caput longum TME – triceps brachii caput mediale]

3.3C – Macroscelidea – Macroscelididae – *Rhynchocyon cirnei stuhlmanni*

The forelimb myology of *Rhynchocyon cirnei* has been described only once, and then it was compared with several lipotyphlans and small afrotheres formerly considered Insectivora (Jullien, 1967). Here I describe the extrinsic and intrinsic muscles of the forelimb of *Rhynchocyon cirnei stuhlmanni*, the Checkered Elephant Shrew (Macroscelidea: Macroscelididae). The specimen was collected for the American Museum of Natural History in Zaire in 1927. The pollux is absent on both forefeet, as is typical for *Rhynchocyon*, and the right forefoot has a small digit V while the left forefoot is lacking this digit. The specimen was in fairly good condition despite some shot wounds that fractured the humerus and damaged the muscles of the trapezius complex.

Figure 3.3C-1. Pre-dissection photograph of *Rhynchocyon cirnei*, AMNH 82364.

0. CUTANEOUS MUSCULATURE

mm. cutaneous ventralis, sphincter colli, panniculus carnosus, dorsocutaneous

Mm. cutaneous ventralis is thin and has no bony insertion.

M. sphincter colli is 7 mm wide, stretching from the occipital midline and ending in the ventral neck proximal to the insertion of m. sternomastoideus on the manubrium. Its fibers are mingled with those of the underlying m. clavotrapezius.

M. panniculus carnosus is thin and covers the back and sides of the animal. It inserts on the tip of the metacromion, superficial to mm. omotransversarius and acromiotrapezius.

M. dorsocutaneous was not observed, but see "m. intermediate trapezius" as the cutaneous muscle may have achieved a bony insertion.

A. TRAPEZIUS GROUP – ACCESSORY NERVE and CERVICAL NERVES

mm. sternomastoideus, cleidomastoideus, clavotrapezius, acromiotrapezius, "intermediate trapezius," spinotrapezius

M. sternomastoideus is large where it originates from the mastoid process, but looks delicate and flat where it meets its partner at the ventral midline. It inserts superficial to m. pectoralis superficialis for 2 cm along the manubrium and sternum.

M. cleidomastoideus is 5 mm wide and originates from the mastoid process deep to m. sternomastoideus and inserts on the medial clavicle. It travels deep to m. sternomastoideus and is much smaller.

M. clavotrapezius originates on the occiput in the same plane as m. acromiotrapezius; its caudal edge is connected with m. acromiotrapezius. There is also a slip to the base of the auricle. M. clavotrapezius inserts on the lateral clavicle and is much more robust than m. clavotrapezius of *Petrodromus*. An unusual situation within mammals is that m. clavotrapezius travels deep to m. omotransversarius, and because of this the great auricular nerve emerges from between mm. omotransversarius and clavotrapezius. The accessory nerve travels on the deep surface of mm. clavotrapezius and acromiotrapezius medial to the great auricular nerve.

M. acromiotrapezius originates along the ligamentum nuchae and the proximal thoracic vertebrae in what initially appears to be a single sheet. However, like the formation of m. acromiotrapezius in *Petrodromus* and *Elephantulus*, the muscle divides into cranial and caudal portions. The cranial portion is 7 mm wide and stretches 3 cm long. It tapers to a rounded point and inserts on the metacromion deep and cranial to the insertion of m. omotransversarius. The larger, triangular, and more caudal portion is 2 cm wide and inserts along the majority of the caudal edge of the spine of the scapula.

Contrary to the description given by Jullien (1967) there is also "m. intermediate trapezius" in this specimen of *Rhynchocyon*, between and connected by fascia to mm. acromiotrapezius and spinotrapezius. This intermediate muscle originates on several thoracic vertebrae immediately caudal to acromiotrapezius and has no bony insertion. Instead, it forms a fleshy connection between the caudal border of the caudal portion of m. acromiotrapezius and the cranial border of m. spinotrapezius.

M. spinotrapezius covers both mm. latissimus dorsi and infraspinatus. It originates in the thoracolumbar fascia and from the first lumbar vertebra, leaving a wide gap between its origin and the origin of “m. intermediate trapezius.” The muscle is a long rectangular sheet that shares muscle fibers with “m. intermediate trapezius” before inserting at the base of the spine of the scapula, more towards its cranial edge.

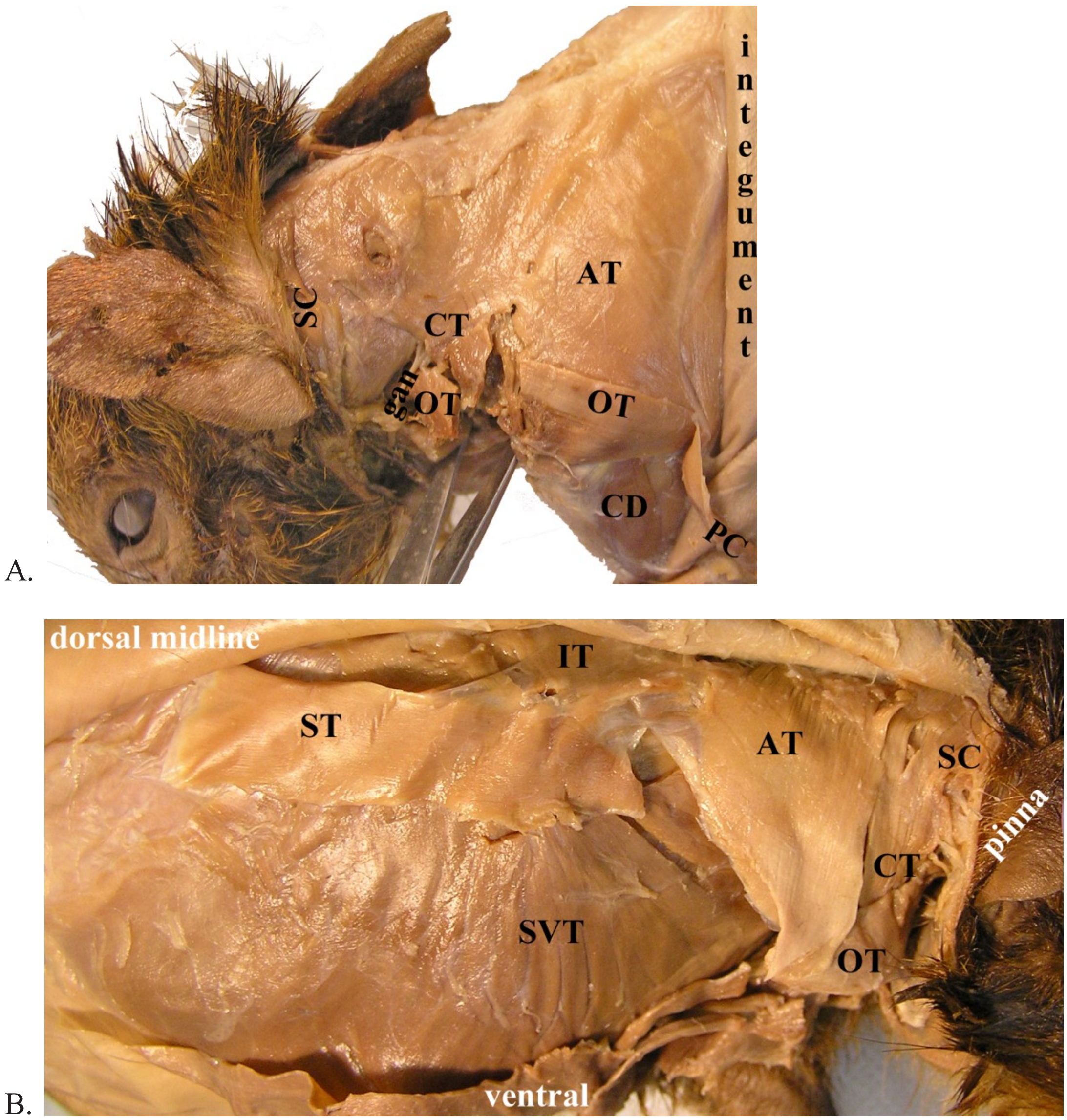
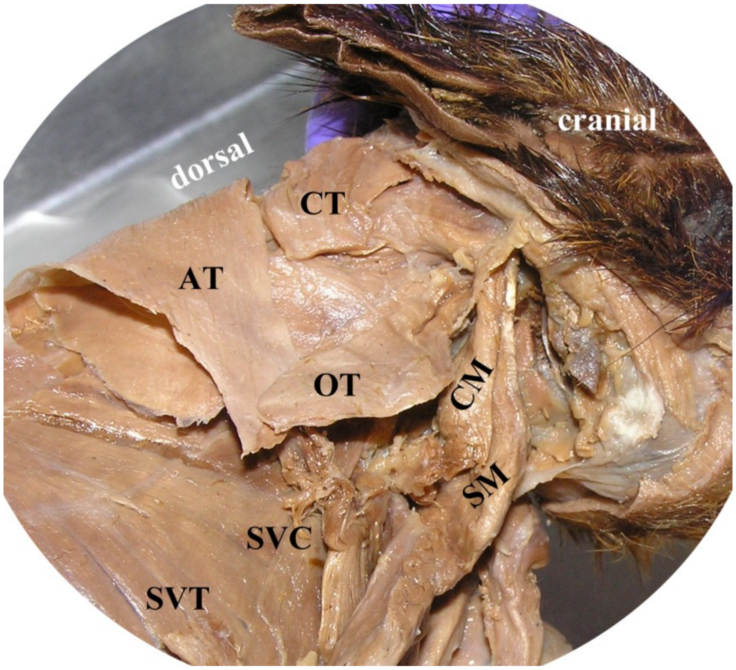
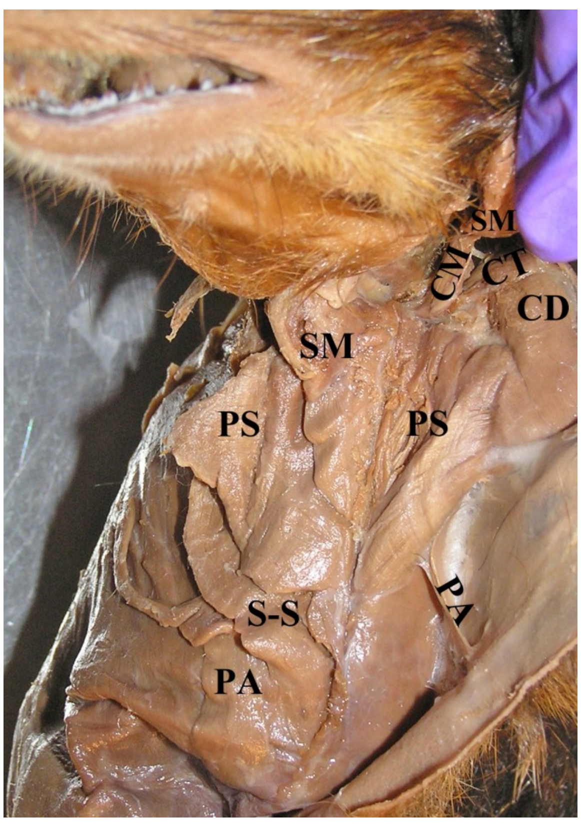


Figure 3.3C-2. Trapezius complex. A. Superficial lateral view of mm. clavotrapezius and acromiotrapezius, left side (P4023071). B. Superficial lateral view of trapezius complex, right forelimb removed (P6020052).

[AT- acromiotrapezius, CD- clavodeltoideus, CT- clavotrapezius, gan- great auricular nerve, IT- intermediate trapezius, OT- omotransversarius, PC- panniculus carnosus, SC- sphincter colli, ST- spinotrapezius, SVT- serratus ventralis thoracis]



C.



D.

AT- acromiotrapezius,
CD- clavodeltoideus,
CM- cleidomastoideus,
CT- clavotrapezius,
OT- omotransversarius,
PA- pectoralis abdominalis,
PS- pectoralis superficialis,
S-S- sternoscapularis,
SM- sternomastoideus,
SVC- serratus ventralis cervicis,
SVT- serratus ventralis thoracis

Figure 3.3C-2 continued. Trapezius complex. C. Deeper lateral view of trapezius complex, right forelimb removed (P4023082). D. Ventral view, right forelimb removed and left m. sternomastoideus reflected (P4023097).

B. RHOMBOID GROUP – DORSAL SCAPULAR NERVE

mm. rhomboideus capitis, rhomboideus cervicis, rhomboideus thoracis

M. rhomboideus capitis originates from the occiput. It is 3 mm wide and passes just behind the ear, then fuses with m. rhomboideus cervicis.

M. rhomboideus cervicis has a 2.4 cm origin along the cervical midline, slightly overlapping m. rhomboideus thoracis. The muscle is 6 mm wide and, after fusing with m. rhomboideus capitis, has a fleshy insertion into the middle 50% of the vertebral border of the scapula. A small ridge marks the point of insertion.

M. rhomboideus thoracis has a 3.2 cm-origin along the spinous processes of the proximal few dorsal vertebrae. The muscle fibers are fairly long and run horizontally between the vertebrae and the scapula. There is a fleshy insertion into both the superficial and deep surfaces of the scapula near its caudal angle, and onto the surface of m. serratus ventralis thoracis which also inserts there.

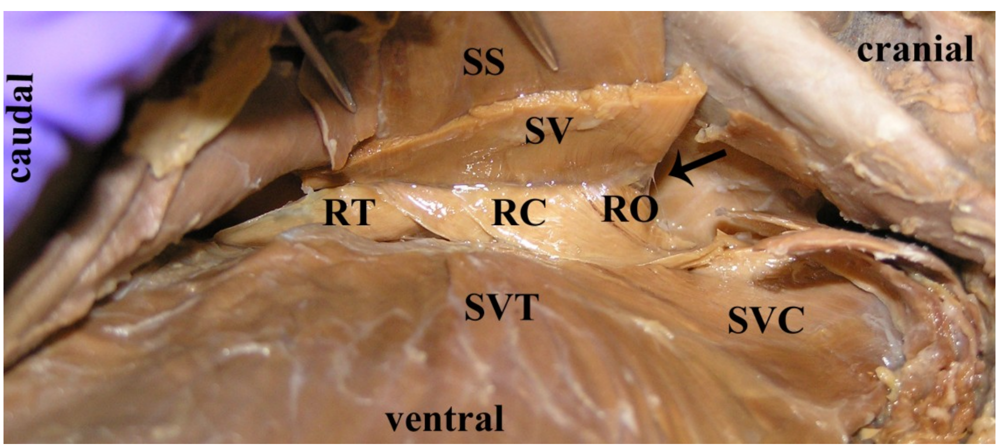


Figure 3.3C-3. Mm. rhomboideus, ventral view. Mm. serratus ventralis transected (P7280050). Forceps on deep surface scapula and arrow marks cranial angle scapula.

[SS- subscapularis, SV- serratus ventralis, SVC- serratus ventralis cervicis, SVT- serratus ventralis thoracis, RC- rhomboideus cervicis, RO- rhomboideus capitis, RT- rhomboideus thoracis]

C. OMO GROUP – CERVICAL NERVES, LONG THORACIC NERVE

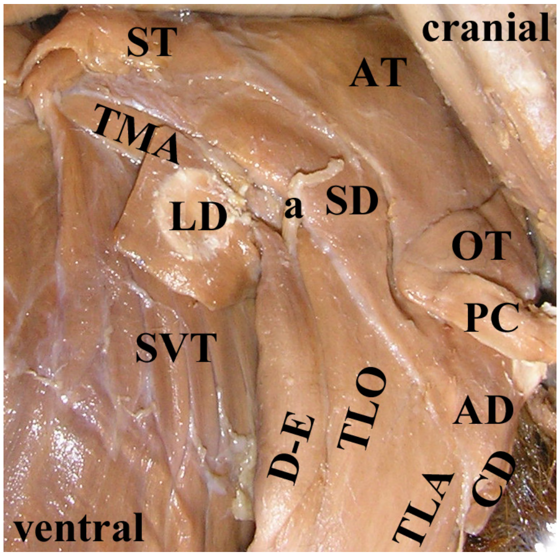
mm. omotransversarius, omohyoideus, serratus ventralis (cervicis, thoracis)

M. omotransversarius originates from the atlas. The muscle is 8 mm wide and 2 cm long and inserts on the tip of the metacromion deep to the insertion of m. panniculus carnosus. M. omotransversarius is unusual in crossing superficial to m. clavotrapezius, rather than deep to it, as it heads to insertion on the metacromion.

M. omohyoideus is absent.

The two portions of m. serratus ventralis are separable but encased in fascia that binds them together, and they insert together. M. serratus ventralis cervicis is 2 cm of robust muscle fibers originating via three digitations from the transverse processes of the second to fifth cervical vertebrae. These digitations are more clearly distinct in *Rhynchocyon* than in *Elephantulus* and *Petrodromus*. M. serratus ventralis thoracis is a 1 cm band of muscle fibers which originates from the ribs via five distinct digitations. The two portions of m. serratus ventralis insert on the cranial angle of the scapula and in a wide band along the ventral surface of its vertebral border just lateral to the insertions of mm. rhomboideus.

A.



[a- axillary nerve, AD- acromiodeltoideus, AT- acromiotrapezius, BB- biceps brachii, bp – brachial plexus, CD- clavodeltoideus, D-E- dorso-epitrochlearis, LD- latissimus dorsi, OT- omotransversarius, PA- pectoralis abdominalis, PC- panniculus carnosus, PP- pectoralis profundus, PS- pectoralis superficialis, S-S- sternoscapularis, SD- spinodeltoideus, SM- sternomastoideus, SS- subscapularis, ST- spinotrapezius, SVC- serratus ventralis cervicis, SVT- serratus ventralis thoracis, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, TMA- teres major]

B.

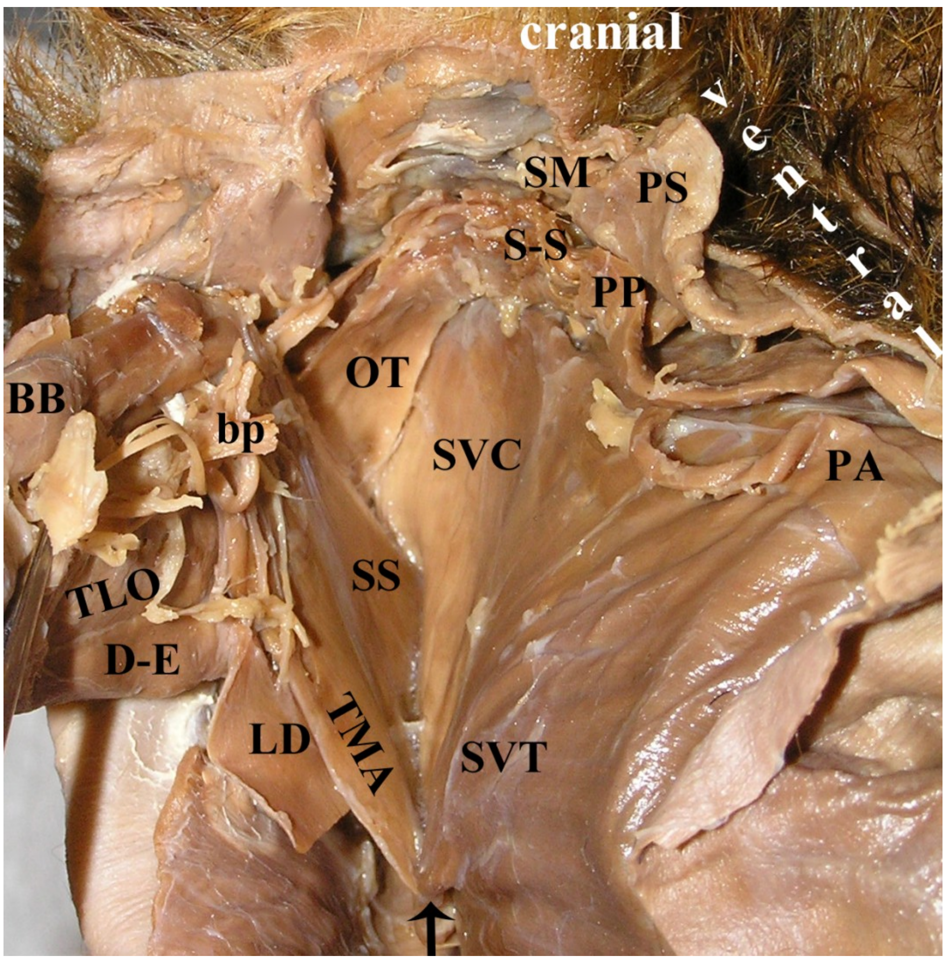


Figure 3.3C-4. Mm. omotransversarius and serratus ventralis.

A. Superficial lateral view of shoulder (P6040022). B. Ventral view, scapula reflected laterally. Arrow marks caudal angle of scapula (P7280047).

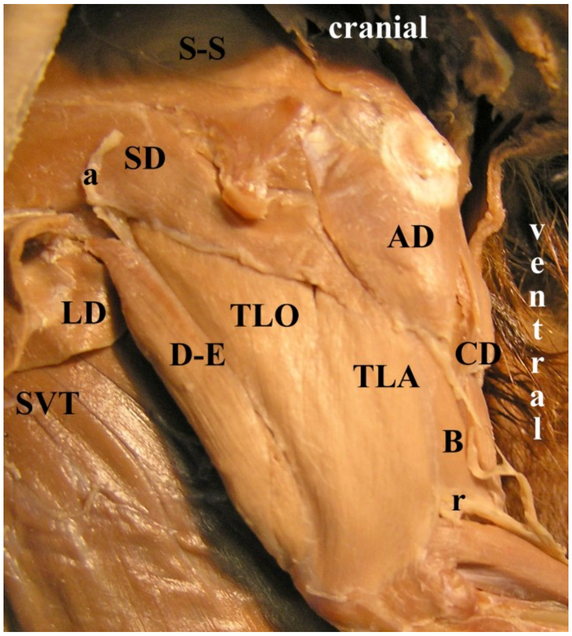
D. DELTOID GROUP – AXILLARY NERVE

mm. clavodeltoideus, acromiodeltoideus, spinodeltoideus, teres minor

M. clavodeltoideus has a shot wound but the origin and insertion are not damaged. It is a narrow, triangular muscle that originates from the clavicle. It lies just medial to m. acromiodeltoideus, an elongate ovoid muscle, 6 mm at its widest, that has a tendinous origin from the acromion. The two muscles fuse 4 mm prior to insertion. Thus, surrounding the shoulder there is a large, two headed muscular cup, which has one long line of insertion via fleshy fibers on the lateral side of the deltopectoral crest of the humerus.

M. spinodeltoideus originates on the proximal half of the scapular spine and from the fascia over the middle of m. infraspinatus. It inserts on the humerus just lateral to m. acromiodeltoideus, via thin tendinous fibers. It also inserts on the fascia over the edge of m. triceps brachii caput laterale. A branch of the axillary nerve emerges from between mm. triceps brachii caput longum et laterale to supply m. spinodeltoideus.

M. teres minor takes origin from the shiny fascia of mm. infraspinatus and triceps brachii caput longum and along the cranial third of the neck of the scapula. The muscle narrows, becomes slightly tendinous, and inserts on the greater tuberosity of the humerus just distal to the insertion of m. infraspinatus.

A. 

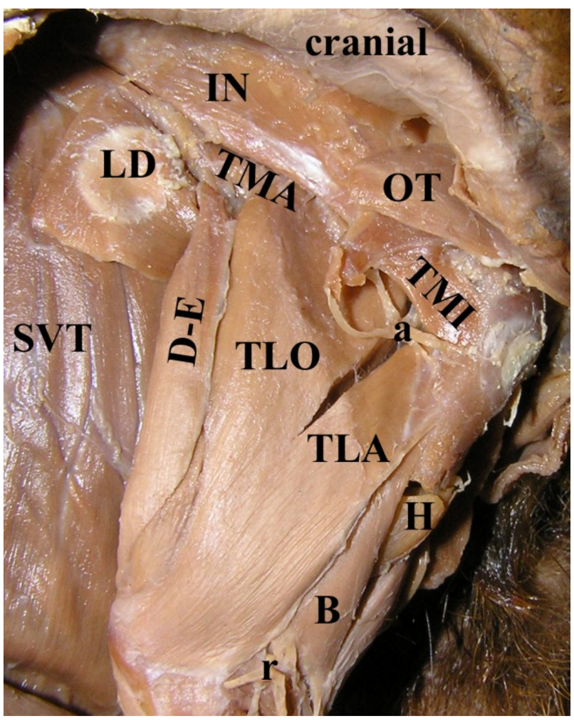
B. 

Figure 3.3C-5. Mm. deltoideus and teres minor.
A. Superficial lateral view (P6040028). B. Deep lateral view (P6050041).

[a- axillary nerve, AD- acromiodeltoideus, B- brachialis, CD- clavodeltoideus, D-E- dorso-epitrochlearis, H- humerus, IN- infraspinatus, LD- latissimus dorsi, OT- omotransversarius, r- radial nerve, S-S- sternoscapularis, SD- spinodeltoideus, SVT- serratus ventralis thoracis, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, TMA- teres major, TMI- teres minor]

E. SUBSCAPULAR GROUP – SUBSCAPULAR NERVE

mm. subscapularis, teres major

M. subscapularis originates in the fossa on the deep surface of the scapula and becomes fleshy 1 cm from the vertebral border of the scapula. It inserts via mixed fleshy and tendinous fibers into a small fossa on the lesser tuberosity. It also inserts on the gleno-humeral joint capsule. Deep to m. subscapularis, the flat tendon of m. triceps brachii caput longum profundus originates from the neck of the scapula.

M. teres major originates from m. subscapularis and from the very tip of the caudal angle of the scapula and extends for 2.3 cm along the caudal border of the scapula. The muscle does not fuse with m. latissimus dorsi but inserts adjacent to it on the medial side of the bicipital groove of the humerus. The muscle is fleshy on its proximal half and tendinous on its distal half.

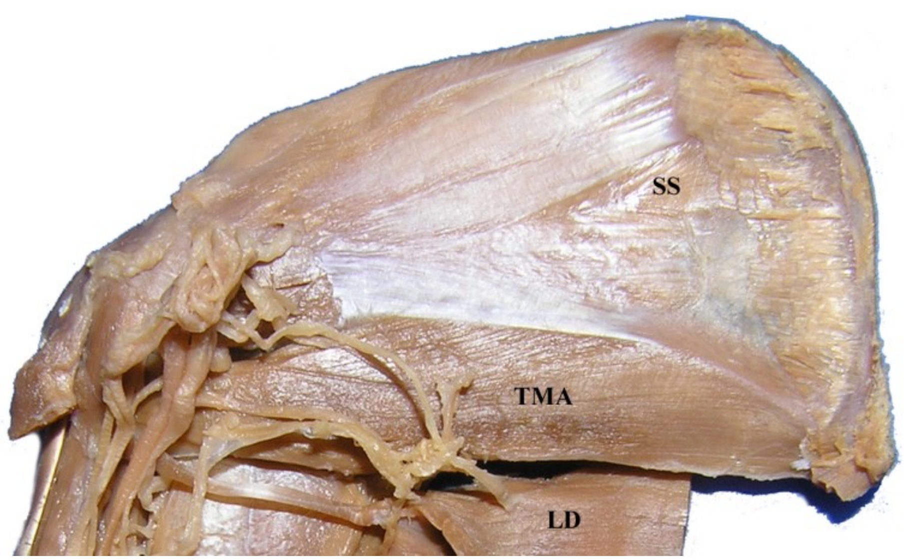


Figure 3.3C-6. Mm. subscapularis and teres major, medial view.

F. LATISSIMUS GROUP – THORACODORSAL NERVE

m. latissimus dorsi

M. latissimus dorsi is a flat, triangular sheet of muscle mostly covered at its origin by spinotrapezius. The muscle has a 3 cm-long origin from the spinous processes of the thoracic and first lumbar vertebra. The proximal end of the muscle has a fleshy origin and the distal 1 cm of the muscle originates from the thoracolumbar fascia. M. latissimus dorsi abruptly becomes tendinous almost immediately after the origin of m. dorso-epitrochlearis. The tendon of m. latissimus dorsi is 1.5 cm long and less than 1mm wide. It inserts on the medial side of the distal end of the bicipital groove under cover of mm. biceps brachii.

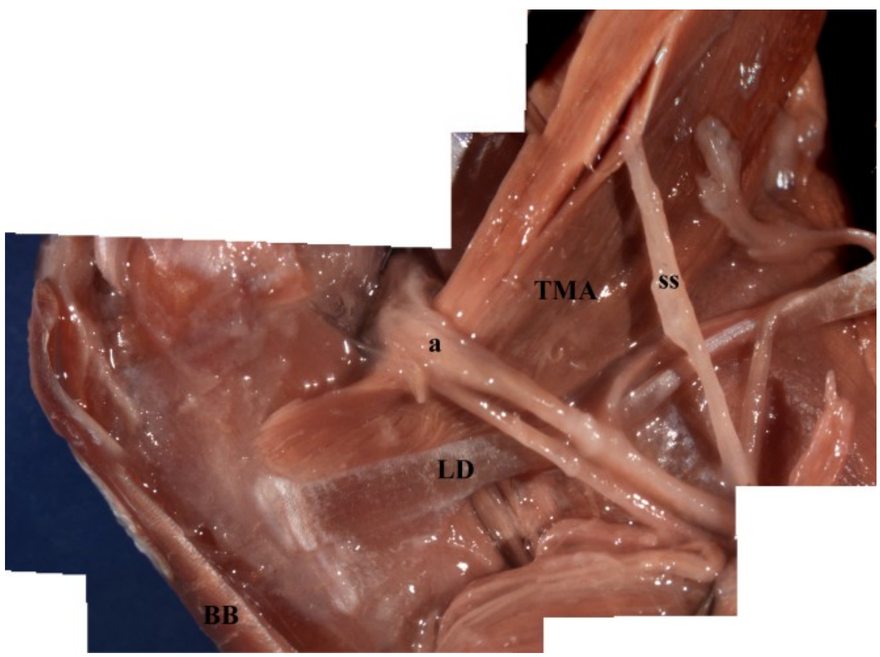


Figure 3.3C-7. Mm. latissimus dorsi and teres major inserting on cranial aspect of humerus.

[a- axillary nerve, BB- biceps brachii, LD- latissimus dorsi, ss- subscapular nerve, TMA- teres major]

G. PECTORALS GROUP – PECTORAL NERVES

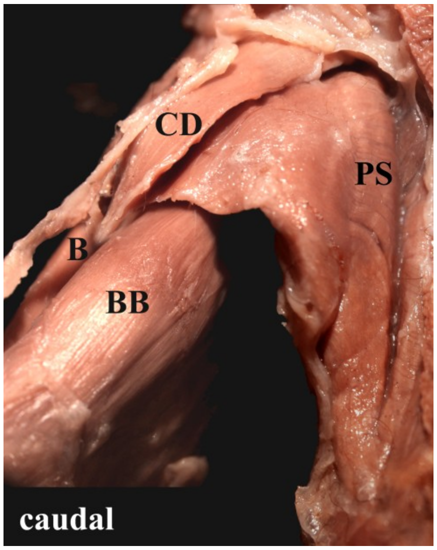
mm. pectoralis superficialis, pectoralis profundus, pectoralis abdominalis, subclavius, sternoscapularis

M. pectoralis superficialis is a vast sheet of muscle originating from the clavicle and manubrium. There is strong fascia covering m. pectoralis superficialis and connecting it with mm. deltoideus. M. pectoralis superficialis inserts on the deltopectoral crest just medial to the insertion of mm. deltoideus and just lateral to the muscle bellies of mm. biceps brachii. It is joined on its caudal edge by a slip from m. panniculus carnosus.

M. pectoralis profundus originates from the caudal 1.5 cm of the sternum and is overlapped just slightly by the caudal edge of m. sternoscapularis. It inserts with m. pectoralis abdominalis on the medial surface of the greater tuberosity.

M. pectoralis abdominalis has no bony origin, but arises 4 mm distal to the origin of m. pectoralis profundus from the fascia over the ventral part of mm. serratus ventralis. It starts out 7 mm wide there, but narrows and remains slimmer than m. pectoralis profundus. Mm. pectoralis abdominalis and pectoralis profundus insert together for 7 mm along a slightly rugose ridge on the medial surface of the greater tuberosity. The insertion is mostly tendinous for its proximal half and fleshy for the distal half.

Jullien (1967) reported three layers of m. sternoscapularis, but I observed only one sheet of muscle. M. sternoscapularis has a 2 cm origin on the sternum midline, deep to m. pectoralis superficialis and cranial to m. pectoralis profundus, disappearing under m. clavodeltoideus. Some ligamentous fibers, perhaps representing m. subclavius, join it to the clavicle, but m. sternoscapularis travels deep to the clavicle. It inserts by expanding to a thin sheet of muscle covering m. supraspinatus and by some fibers reaching the cranial edge of the scapular spine.

A. 

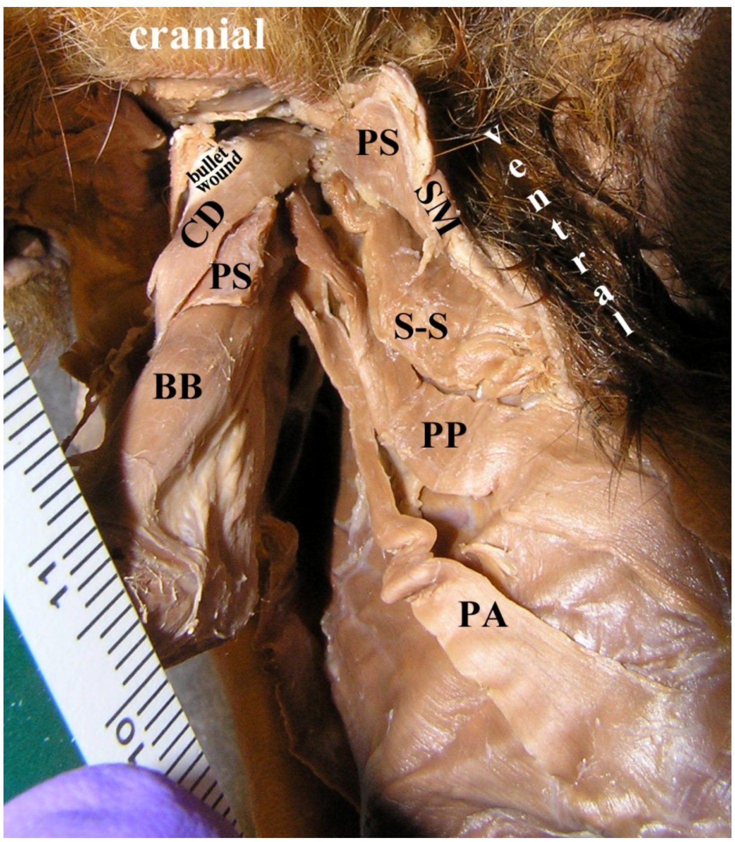
B. 

Figure 3.3C-8. Mm. pectoralis and sternoscapularis, ventral view (P6172013).
A. Superficial dissection. B. Deep dissection (P6030019)

[BB- biceps brachii, CD- clavodeltoideus, PA- pectoralis abdominalis, PP- pectoralis profundus, PS- pectoralis superficialis, S-S- sternoscapularis, SM- sternomastoideus]

H. BICEPS GROUP – MUSCULOCUTANEOUS NERVE

mm. coracobrachialis, biceps brachii, brachialis

M. coracobrachialis originates from the larger and more medial tubercle on the coracoid process, and fuses with the short head of m. biceps brachii. This fusion is 8 mm long, and is both fleshy and tendinous. M. coracobrachialis then inserts along the medial aspect of the humerus for 12 mm, ending quite distally.

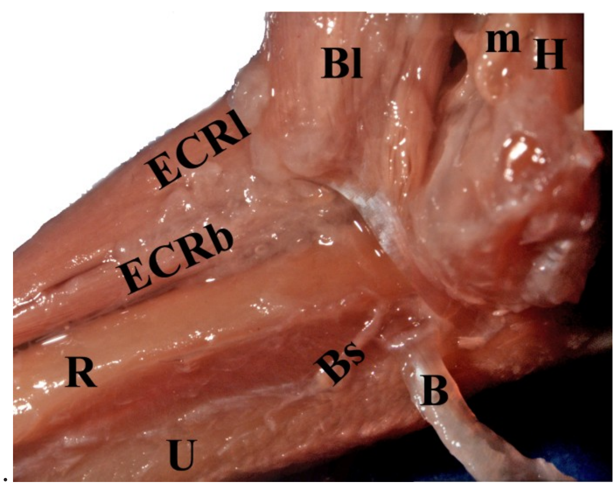
Mm. biceps brachii is comprised of two distinct bellies: long and short. The medial, or short head of m. biceps brachii, originates from the smaller lateral tubercle on the coracoid process and narrows abruptly to a flat tendon 5 mm long and 1 mm wide. About 5 mm after its origin, the short head of m. biceps brachii fuses briefly with m. coracobrachialis. Distally, it is represented by a tiny tendon that inserts on the proximal medial radius. The lateral, or long head of m. biceps brachii, originates from the supraglenoid tubercle, and its 1 mm-wide and 1.5 cm-long tendon passes through the bicipital groove. Distal to the groove the muscle becomes fleshy and the musculocutaneous nerve enters its deep surface. It crosses in front of the coronoid process of the ulna and inserts into the shallow fossa at its base. In the forearm, the lacertus fibrosus is comprised of tough white fascia that joins the lateral edge of mm. biceps brachii to m. pronator teres.

M. brachialis originates just distal to the greater tuberosity and head of the humerus, in a line sweeping from caudo-medial to lateral. In the forearm the muscle is flat, and its 1 mm-wide tendon of insertion follows the same path as that of the long head of m. biceps brachii. There is a smoothed groove on the cranial surface of the proximal radius which may result from this tendon gliding across the bone. The tendon crosses medially in front of the coronoid process and inserts on the ulna just distal to the insertion of the long head of m. biceps brachii and a small vessel heading into the fossa between radius and ulna.

The musculocutaneous nerve crosses deep to m. coracobrachialis and gives off large branches that pass deep to the mm. biceps brachii.

B- brachialis,
Bl- long head biceps brachii,
Bs- short head biceps brachii,
CB- coracobrachialis,
ECRb- extensor carpi radialis brevis,
ECRl- extensor carpi radialis longus,
H- humerus,
m- median nerve,
mc- musculocutaneous nerve,
PT- pronator teres,
R- radius,
SS- subscapularis,
U- ulna

A.



B.

Figure 3.3C-9. Muscles of the biceps group.
A. Origins, medial view (P6173340). B. Insertions, medial view (P6173380).

I. SPINATI GROUP – SUPRASCAPULAR NERVE

mm. supraspinatus, infraspinatus

M. supraspinatus originates from the supraspinous fossa, the cranial surface of the spine of the scapula, and the superior border of the scapula. The fibers converge to a central tendon. Its 5 mm-wide insertion is via fleshy and tendinous fibers into the top of the greater tuberosity of the humerus.

M. infraspinatus is a long, triangular muscle which originates via fleshy fibers from the entirety of the infraspinous fossa. It is also connected to the deep surface of the metacromion process. The muscle narrows to a stout 2 mm tendon which inserts into a fossa on the greater tuberosity, just proximal to the insertion of m. teres minor.

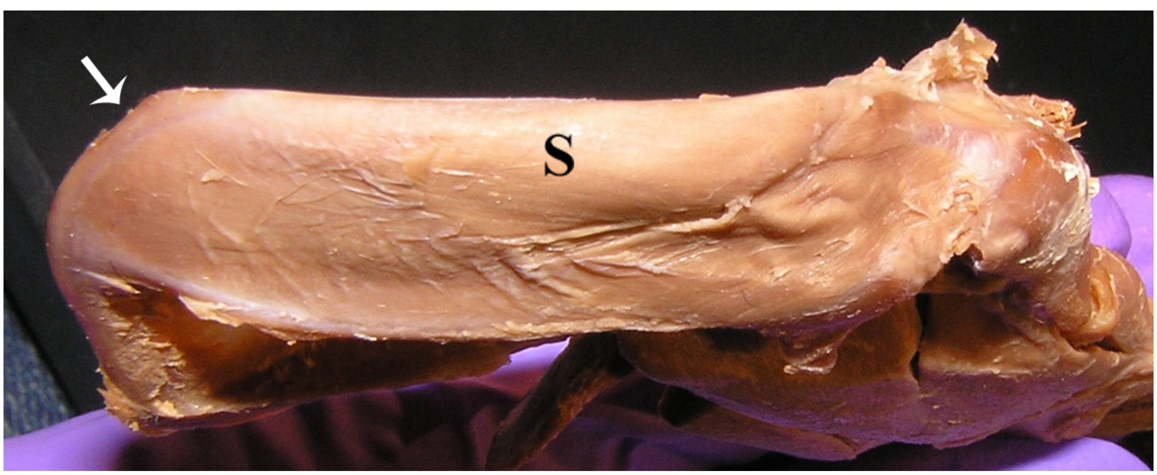


Figure 3.3C-10. M. supraspinatus [S], cranio-lateral view (PA240012).
White arrow marks cranial angle of scapula.

J. TRICEPS GROUP – RADIAL NERVE

mm. dorso-epitrochlearis, triceps brachii (caput laterale, caput mediale, caput longum), anconeus

M. dorso-epitrochlearis originates from the ventral edge of m. latissimus dorsi around the level of the caudal angle of the scapula. The muscle is robust, covering almost the entire caudal surface of m. triceps brachii caput longum and inserting on the medial surface of the olecranon superficial to the insertion of m. triceps caput mediale.

As in Tubulidentata and the other macroscelidids, m. triceps brachii caput longum is doubled. The two parts of the muscle are covered at origin near the neck of the scapula by adipose and lymphatic tissue and by m. spinodeltoideus, and on their caudal surface by m. dorso-epitrochlearis. M. triceps brachii caput longum superficialis, visible in lateral view, has a 12 mm fleshy origin off the caudal edge of the scapula, beginning where m. teres major ends its scapular attachment. In medial view, m. triceps brachii caput longum profundus originates as a 3 mm-wide tendon from a little tubercle on the neck of the scapula. The two portions fuse and their robust tendon slides in a groove over the tip of the olecranon, inserting into the fossa on the caudo-lateral olecranon.

M. triceps brachii caput laterale originates by fleshy fibers from the caudo-lateral edge of the head of the humerus, and also by tendinous fibers from the lateral surface of the deltopectoral crest and the surface of m. brachialis. The muscle connects distally with the two heads of m. triceps brachii caput longum, but no fibers insert on the caudal surface of the olecranon. Instead, the muscle inserts onto a horizontal ridge on the lateral side of the proximal ulna. It does not touch m. dorso-epitrochlearis at all.

The origin of the triceps brachii caput mediale was slightly damaged in this specimen due to shot fracturing the humerus. There seem to be two layers of the muscle originating on the distal half of the medial surface of the humerus, but this may be due to the damage. The muscle is fleshy and inserts on the medial side of a marked groove along the olecranon process and on the medial side of the cranial surface of the olecranon. It does not fuse with m. triceps brachii caput longum.

M. anconeus is a triangular muscle belly which originates from the majority of the caudal surface of the humerus and lateral epicondyle, deep to the other portions of mm. triceps brachii. It inserts on the lateral half of the cranial surface of the olecranon.

Figure 3.3C-11. Mm. triceps brachii.
A. Superficial lateral view, entire forelimb (PA240007). B. Superficial medial veiw, entire forelimb (PA240006). C. Deep lateral view showing m. anconeus, D. Deep medial view, showing m. triceps brachii caput mediale (PC020002).

K. EXTENSOR GROUP – RADIAL NERVE

mm. brachioradialis, extensors carpi radialis longus et brevis, extensor digitorum communis, extensor digitorum lateralis, extensor carpi ulnaris, supinator, abductor pollicis longus, extensor digitorum profundus

M. brachioradialis is absent.

M. extensor carpi radialis longus originates for 4 mm along the lateral supracondylar crest. The deeper and more tendinous m. extensor carpi radialis brevis originates from a small depression on the cranial surface of the distal humerus, just medial to the origin of m. extensor carpi radialis longus. About 1.3 cm distal to the origin, around the level of the radial midshaft, the two portions of m. extensor carpi radialis fuse. The muscle is completely tendinous by the time it crosses deep to the tendon of m. abductor pollicis longus in the distal forearm. At the carpus, the tendon splits into a slender medial and a robust lateral tendon. These two tendons insert on the dorsal surface of the base of metacarpals II and II.

M. extensor digitorum communis has a fleshy origin off the lateral epicondyle, extending 1.8 cm before it splits into two bellies. About 7 mm farther the lateral belly becomes tendinous, and goes on to insert as an expansion on digit IV. The other belly divides again 5 mm more distally into a very thin middle belly, which is mostly tendinous and inserts by expansion on digit III, and a medial belly which becomes tendinous at the same level as the lateral belly and inserts on the medial (radial) side of digit II.

M. extensor digitorum lateralis originates from the lateral epicondyle of the humerus, cranial and medial to the origin of m. extensor carpi ulnaris, and from the tendon of origin of m. extensor digitorum communis. The muscle gives off two tendons.

The larger inserts on the base of the distal phalanx of digit IV, and the smaller inserts on the base of the distal phalanx of digit V. A thick fascial septum separates m. extensor digitorum lateralis from m. extensor digitorum communis.

M. extensor carpi ulnaris originates via tendon on the lateral epicondyle of the humerus, with a few fibers originating on the lateral edge of the ulna, and from fascia over m. extensor digitorum profundus. The muscle becomes tendinous at the midpoint of the ulna, to which it is closely applied. Its tendon and the tendon of m. extensor digitorum lateralis slide together in a groove along the cranial surface of the ulna. It inserts on the lateral side of the base of metacarpal V.

M. supinator is a tiny muscle, only 7 mm long, which originates from the cranial surface of the lateral epicondyle. At origin it is connected on its lateral edge to the robust annular ligament connecting the head of the radius with the lateral epicondyle. It inserts on the cranial surface of the radius.

M. abductor pollicis longus is a long triangular muscle. It originates via fleshy fibers along 2.25 cm of the cranial edge of the ulna and from the crevice between the radius and ulna. It almost immediately becomes a broad, flat tendon, which tapers as it crosses medially over the carpus. It inserts on the medial corner of metacarpal II. Due to the absence of the pollex, this is different from *Petrodromus*, where m. abductor pollicis longus inserts on the base of metacarpal I.

M. extensor digitorum profundus originates from the caudal edge of the lateral ulna and, crossing over metacarpal III, inserts on the lateral side of digit II.

The radial nerve sends the posterior interosseous branch deep to m. extensor carpi radialis, and emerges from deep to the lateral edge of m. supinator to run along the surface of m. abductor pollicis longus. The rest of the radial nerve continues as the superficial radial nerve along the forearm between mm. extensor carpi radialis and extensor digitorum communis. It crosses the carpus approximately where the pollex would be to supply sensory innervation to the dorsum of the manus.

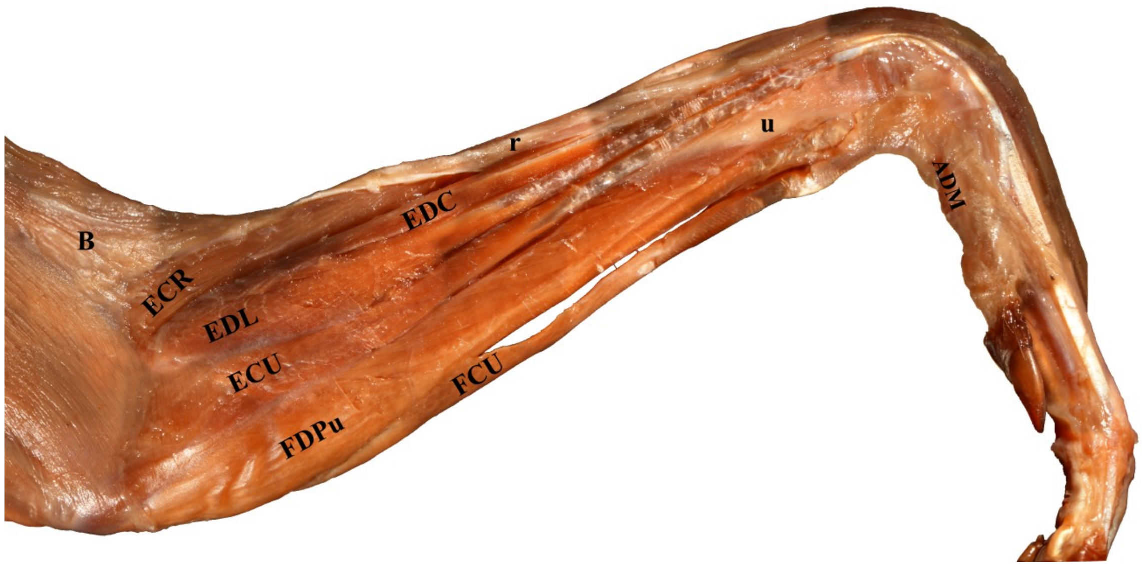
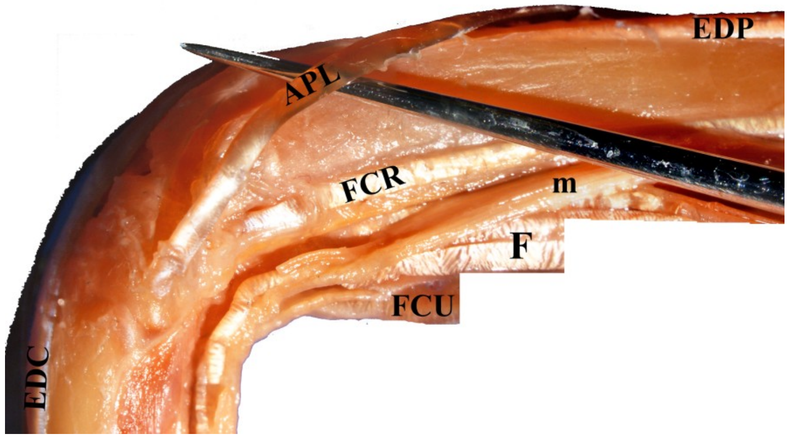


Figure 3.3C-12. Muscles originating from the lateral epicondyle, lateral view.

Figure 3.3C-13. Mm. supinator and abductor pollicis longus, lateral view.

[A- anconeus, APL- abductor pollicis longus, B- brachialis, ECR- extensor carpi radialis, ECRb- extensor carpi radialis brevis, ECRl- extensor carpi radialis longus, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, FDPu- flexor digitorum profundus ulnar head, P- supinator, r- radial nerve, u- ulnar nerve]



A.

B.

C.

Figure 3.3C-14. Extensor tendons in the manus. A. Medial (radial) view (P6179120). B. Dorsal view (P6178520). C. Lateral (ulnar) view (P6179030).

[APL- abductor pollicis longus, B- brachialis, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, EDP- extensor digitorum profundus, F- conjoined tendon of flexor digitorum profundus, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, FDPu- flexor digitorum profundus ulnar head, m- median nerve, P- supinator, r- radial nerve, u- ulnar nerve]

L. FLEXOR GROUP – MEDIAN and ULNAR NERVES

mm. pronator teres^{m}, flexor carpi radialis^{m}, palmaris longus^{u}, flexor digitorum superficialis^{m}, flexor digitorum profundus^{m+u}, flexor carpi ulnaris^{u}, epitrochleo-anconeus^{u}, pronator quadratus^{m}

M. pronator teres is the most proximal muscle originating off the medial epicondyle. This muscle is thick at its origin and is not fused with the flexors. It inserts via both tendinous and fleshy fibers on the cranio-medial surface of the radius at about midshaft. The median nerve passes deep to m. pronator teres and innervates the muscle. The function of this muscle seems mysterious, as no pronation is possible.

M. flexor carpi radialis is the next muscle originating from the medial epicondyle, and also takes origin off m. flexor digitorum superficialis and the elbow joint capsule. About 1.5 cm after its origin a central tendon appears and the muscle becomes completely tendinous by midshaft of the radius. A strong tube of fascia binds the tendon to the sharp medial edge of the radius. M. flexor carpi radialis travels deep through this fibrous tunnel to insert onto the palmar surface of the base of metacarpal II. The median nerve emerges in the forearm at the same level as the appearance of the tendon of m. flexor carpi radialis and innervates the muscle.

M. palmaris longus has a significant fleshy origin off the humeral belly of m. flexor carpi ulnaris and a few tendinous fibers shared with the superficial belly of m. flexor digitorum superficialis. The muscle is fleshy for only 11 mm before it becomes a slight tendon which expands over the palm as the palmar aponeurosis.

M. flexor digitorum superficialis is a large fleshy mass taking origin from the flange on the medial epicondyle, and from 5 mm on the humeral head of m. flexor carpi ulnaris. About 2 cm distal to the origin it splits into a superficial and a deep belly, which is twice as large as the superficial belly. The superficial belly becomes a broad flat tendon shortly after the split and is perforated by the tendon of m. flexor digitorum profundus for digit III. The deep belly continues for another 1.5 cm before dividing into an extremely thin medial belly and a cylindrical lateral belly. Immediately after this split, fleshy fibers on its deep surface give off very strong tendinous fibers which insert onto the superficial surface of the tendon of m. flexor digitorum profundus. These interconnecting tendinous fibers are called here the "interflexorii," and are occasionally found in other afrotheres and commonly in artiodactyls. The medial and lateral portions of the deep belly continue on beyond the "interflexorii" and become tendons as they cross the carpus. The medial tendon is perforated by the tendon of m. flexor digitorum profundus for digit II and the lateral tendon is perforated by the tendon of m. flexor digitorum profundus for digit IV. M. flexor digitorum superficialis also sends minute tendons of insertion to the sides of digits II-IV.

The median nerve crosses the cubital fossa and passes deep to mm. pronator teres and flexor carpi radialis before emerging and running along m. flexor digitorum superficialis into the manus. In the manus, the first branch passes deep to a tiny retinaculum along the medial edge of digit II to serve m. lumbrical for digit II. The rest of the nerve travels as a large bundle through the center of the palm. The nerve splits into two branches; the medial branch supplies the lateral side of digit II and the medial side of digit III, the lateral branch runs deep to the ulnar artery and supplies the lateral side of digit III.

M. flexor digitorum profundus has four bellies of origin: two bellies from the epicondyle, both receiving median nerve innervation, and one from the ulna, which receives ulnar nerve innervation.

The superficial epitrochlear belly of m. flexor digitorum profundus (FDPe) has a linear origin from the elbow joint capsule and the caudal surface of the medial epicondyle. It becomes a tendon near midshaft and continues for 1 cm before inserting into the conjoined tendon of flexor digitorum profundus. The deep epitrochlear belly of m. flexor digitorum profundus (FDPd) is the smallest of the three heads and originates deep to the superficial belly of m. flexor digitorum profundus and to m. flexor digitorum superficialis. It is quadrilateral and becomes a tendon after 1.5 cm. It inserts on the medial-most side of the conjoined tendon of m. flexor digitorum profundus. The ulnar portion of m. flexor digitorum profundus (FDPu) originates from the medial surface of the olecranon process distal to the insertion of m. epitrochleo-anconeus, and from the majority of the medial side of the ulnar shaft and the caudal edge of the ulna. The origin is mostly fleshy, with some tendinous fibers from near the coronoid process.

Just proximal to the carpus, the tendons of the portions of m. flexor digitorum profundus fuse to become a large conjoined tendon deep to the tendons of m. flexor digitorum superficialis. It starts to differentiate into three tendons, which are fully separated by the midshaft of the metacarpals. One tendon goes to each of digits II-IV, where they perforate through the tendons of m. flexor digitorum superficialis, and insert on the distal phalanx. The middle tendon, associated with digit III, is the biggest.

M. flexor carpi ulnaris has two portions of origin, one from the ulna and one from the humerus. The humeral portion of m. flexor carpi ulnaris has the most caudal origin from the medial epicondyle, via a stout tendon with mixed fleshy fibers. A central tendon and the ulnar nerve run along the deep surface of the muscle belly, which inserts on the pisiform by a strong tendon. The ulnar portion originates from the origin of m. flexor digitorum profundus and inserts onto thin fascia on the surface of the humeral portion of m. flexor carpi ulnaris. Although it is 2.2 cm long and has a robust ulnar nerve branch running along its deep surface, its weak insertion might imply the ulnar portion cannot do more than assist the humeral portion.

M. epitrochleo-anconeus is a 6 mm-long fleshy bundle originating from a tiny tubercle on the caudal surface of the humerus below the entepicondylar foramen and inserting on the medial olecranon, somewhat merged with the ulnar head of m. flexor carpi ulnaris.

The ulnar nerve travels behind the medial epicondyle and deep to m. epitrochleo-anconeus. It enters the deep surface of the ulnar belly of m. flexor carpi ulnaris and sends another branch to the deep surface of the humeral belly of m. flexor carpi ulnaris. It also pierces the ulnar head of m. flexor digitorum profundus. The rest of the nerve runs along the deep surface of m. flexor carpi ulnaris, becoming encased in a little fascial sheath on the medial edge of the tendon to cross the carpus. In the manus, a branch dives deep at the base of digit V to supply the intrinsic muscles, while the rest of the nerve runs along the medial edge of digit V between the digit and the palm and sends branches to the lateral and medial sides of digit IV.

M. pronator quadratus is found in the proximal third of the medial forearm in the furrow between the fused radius and ulna. It is 1 cm long by 3 mm wide.

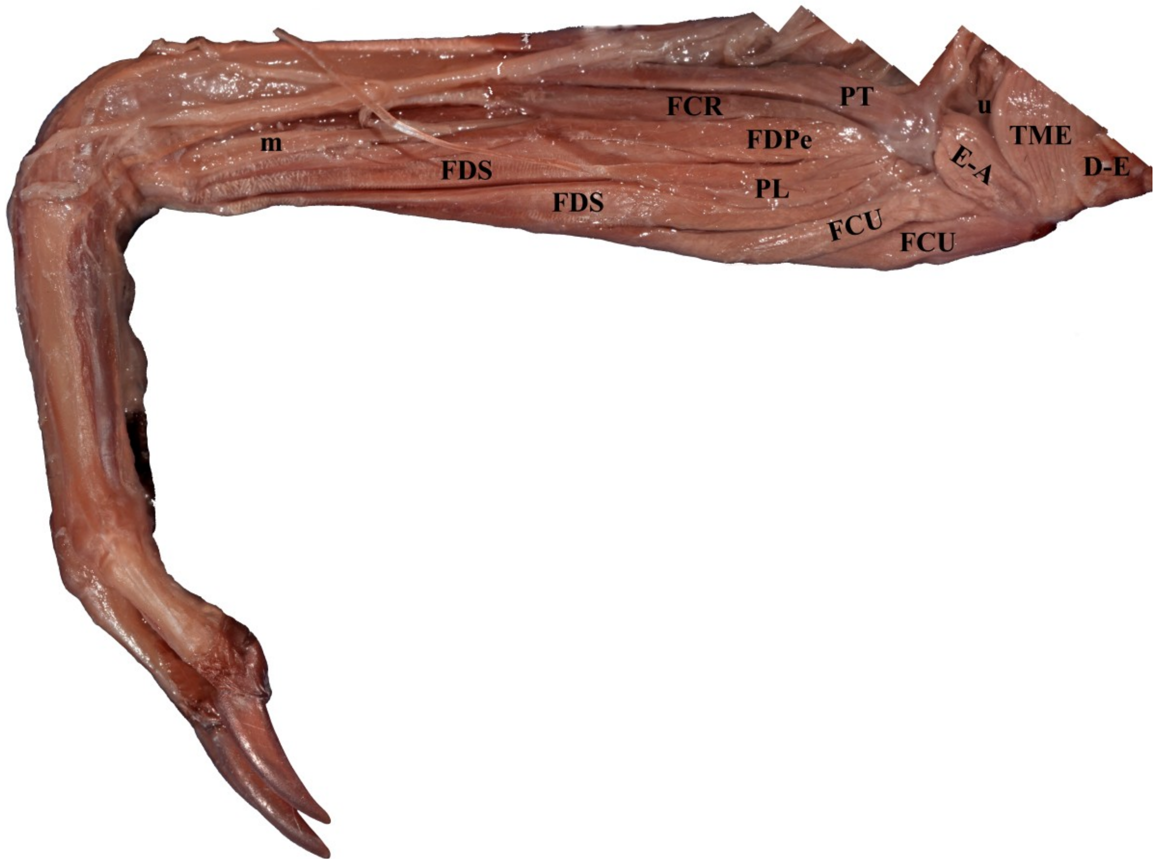
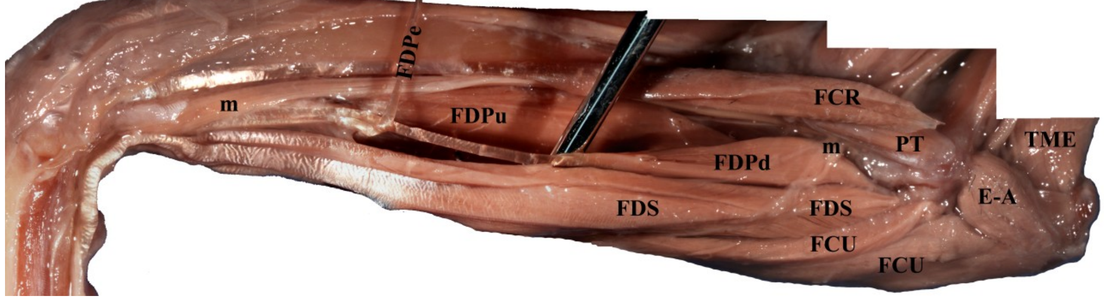


Figure 3.3C-15. Muscles originating from the medial epicondyle, medial view.

[D-E- dorso-epitrochlearis, E-A- epitrochleo-anconeus, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, FDPe- superficial epicondylar head of flexor digitorum profundus, FDPu- ulnar head of flexor digitorum profundus, FDS- flexor digitorum superficialis, m- median nerve, PL- palmaris longus, TME- triceps brachii caput mediale, u- ulnar nerve]

A. 

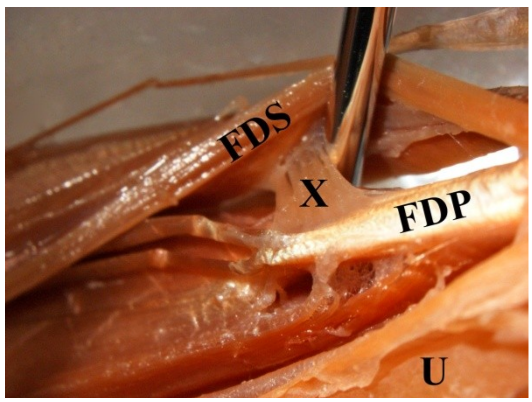
B. 

Figure 3.3C-16. Mm. flexor digitorum superficialis and flexor digitorum profundus. A. Superficial medial view. B. Deep lateral view of m. interflexorii. Proximal is toward the left, distal (manus) is toward the right (PIC0014).

[D-E- dorso-epitrochlearis, E-A- epitrochleo-anconeus, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, FDP- flexor digitorum profundus, FDPd- deep epicondylar head of flexor digitorum profundus, FDPe- superficial epicondylar head of flexor digitorum profundus, FDPu- ulnar head of flexor digitorum profundus, FDS- flexor digitorum superficialis, m- median nerve, PL- palmaris longus, TME- triceps brachii caput mediale, u- ulnar nerve, U-ulna, X- interflexorii]

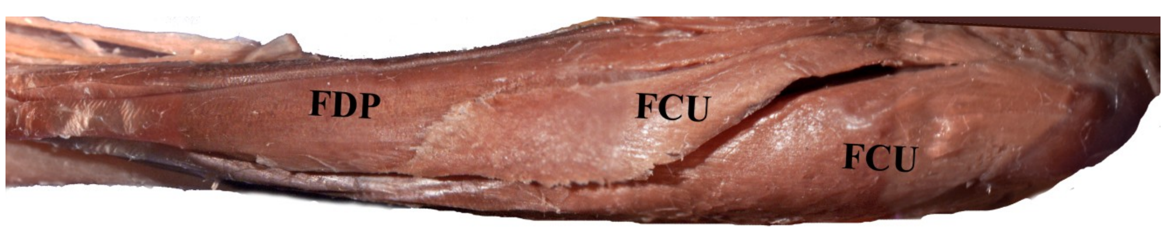


Figure 3.3C-17. M. flexor carpi ulnaris, caudal view (P6182080).

[FCU- flexor carpi ulnaris, FDP- flexor digitorum profundus]

Figure 3.3C-18. M. pronator teres, medial view (P7053520).

[APL- abductor pollicis longus, Bl- biceps brachii long head, ECR- extensor carpi radialis, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, PT- pronator teres, TME- triceps brachii caput mediale]

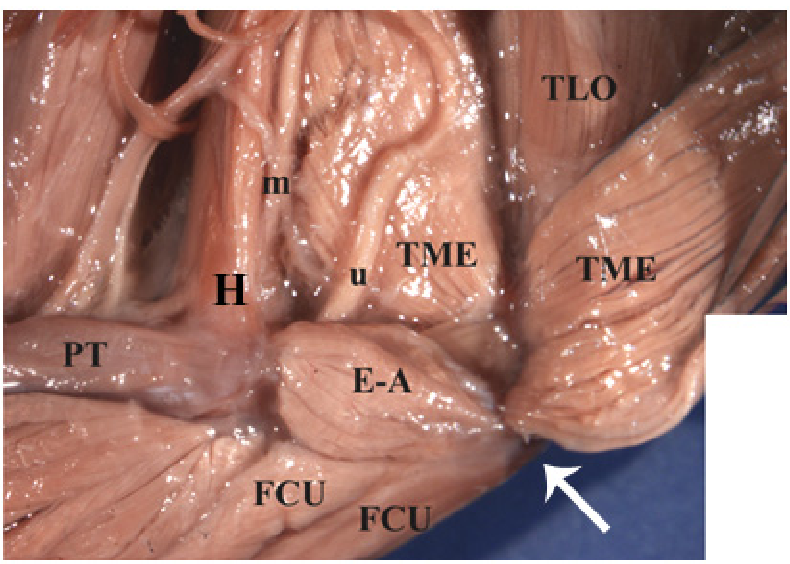


Figure 3.3C-19. M. epitrochleo-anconeus spanning ulnar nerve, medial view of elbow White arrow marks olecranon process (P6182210).

[E-A- epitrochleo-anconeus, FCU- flexor carpi ulnaris, H- humerus, m- median nerve, PT- pronator teres, TLO- triceps brachii caput longum, TME- triceps brachii caput mediale, u- ulnar nerve]

M. MANUS GROUP – MEDIAN and ULNAR NERVES

mm. palmaris brevis, flexor digitorum brevis manus, lumbricales^{m+u}, abductor digiti minimi^{u}, abductor pollicis brevis, contrahentes^{u}, flexor digitorum breves profundus^{u}

M. palamaris brevis and m. flexor digitorum brevis manus were absent.

There are two mm. lumbricales originating between the tendons of m. flexor digitorum profundus and inserting on the medial side of digits III- IV.

M. abductor digiti minimi is a small fusiform belly filling the space between the pisiform and distal metacarpal V, where it inserts. The pollex is absent in *Rhynchocyon*, as is m. abductor pollicis brevis.

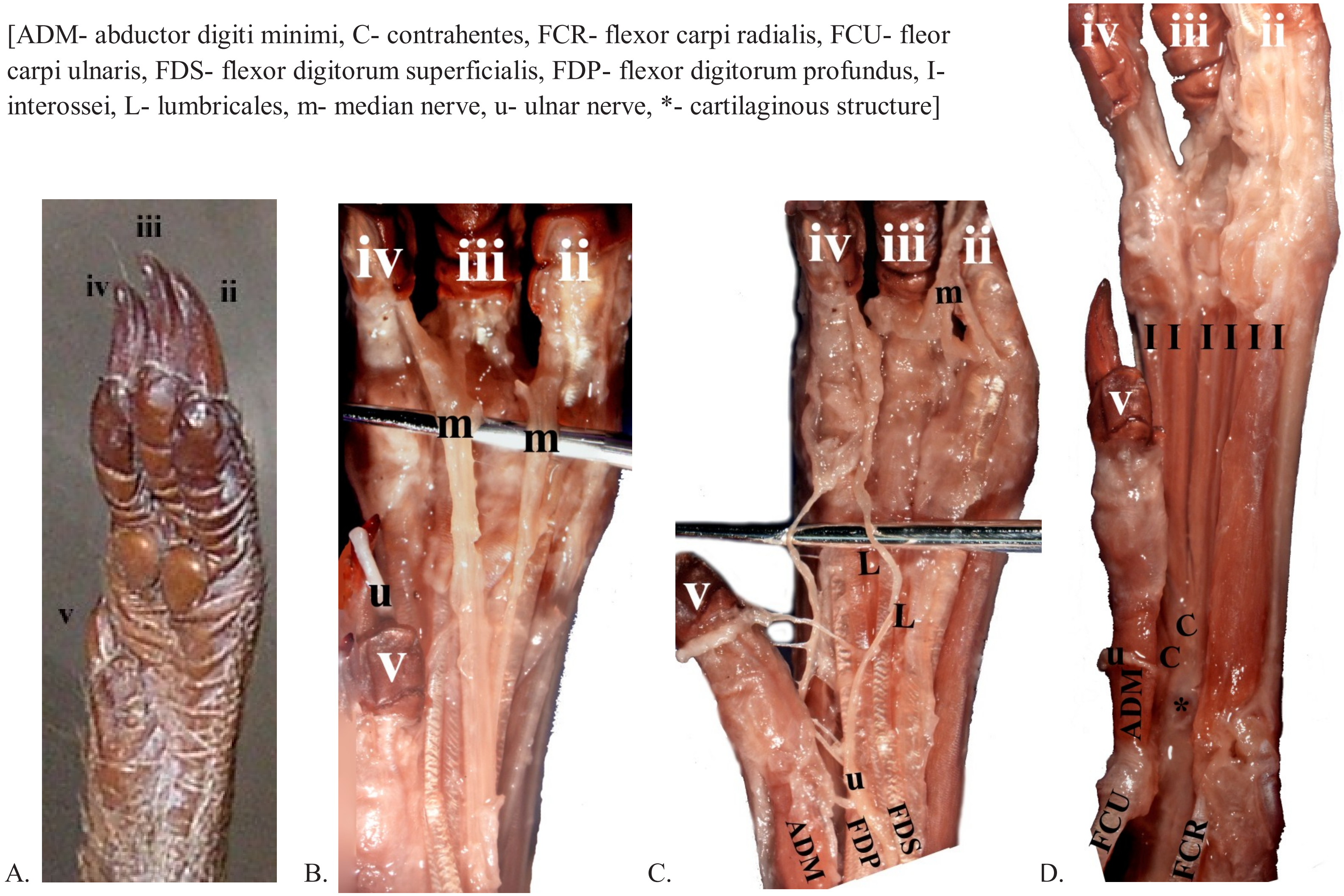
There are three mm. contrahentes in the manus. They originate from the carpus at the base of digit III, and send tiny tendons to the medial side of digits II, IV, and V. This contrasts with the situation in *Elephantulus* and *Petrodromus*, where mm. contrahentes insert on digits I, II, and V. Jullien (1967) had the same finding.

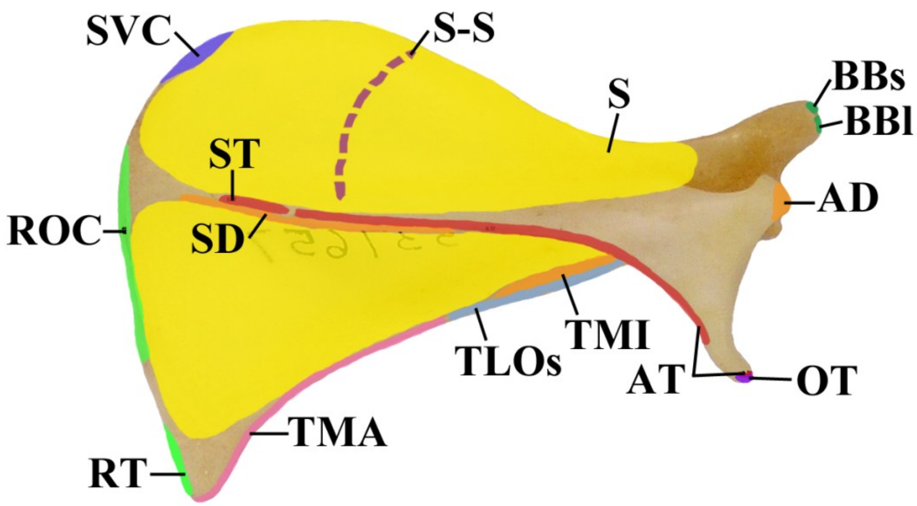
The paired mm. flexor digitorum breves profundus are found on digits II-V, for a total of eight small muscles. They originate from the fibrous tissue around the carpals, and insert on the lateral and medial sides of the cartilaginous tunnels over each metacarpophalangeal joint that surround the tendons of m. flexor digitorum profundus. No opponens muscles are differentiated from mm. flexor digitorum breves profundus.

Figure 3.3C-20. Muscles of the manus.

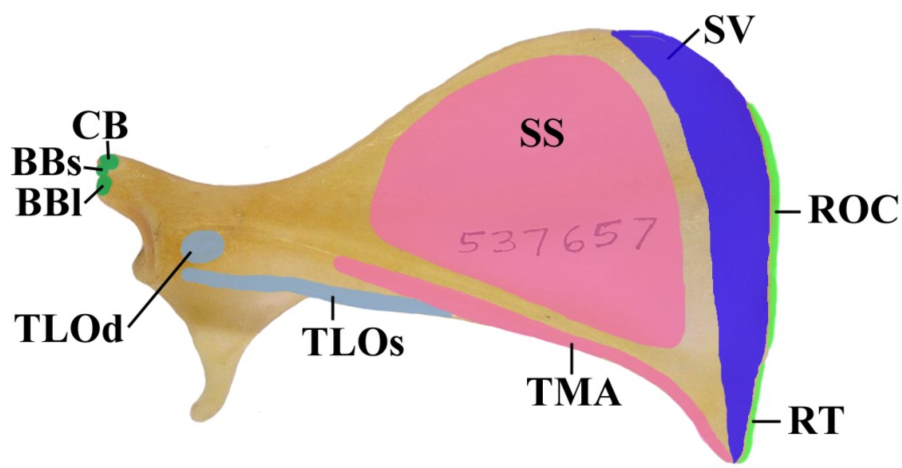
A. Right manus pre-dissection (P2282599). B. Median nerve (P6183270). C. Ulnar nerve and mm. lumbricales (P6183190). D. Mm. contrahentes and flexor digitorum breves profundus (P6182560).

[ADM- abductor digiti minimi, C- contrahentes, FCR- flexor carpi radialis, FCU- fleor carpi ulnaris, FDS- flexor digitorum superficialis, FDP- flexor digitorum profundus, I- interossei, L- lumbricales, m- median nerve, u- ulnar nerve, *- cartilaginous structure]





A.



B.

Figure 3.3C-21. Muscle attachment maps for the scapula.

A. Superficial surface of the scapula. B. Deep surface of the scapula.

[AD- acromiodeltoideus, AT- acromiotrapezius, BBl – glenoid (long) head of biceps brachii, BBs – coracoid (short) head of biceps brachii, CB- coracobrachialis, IN- infraspinatus, OT – omotransversarius, ROC- rhomboideus capitis et cervicis, RT- rhomboideus thoracis, S- supraspinatus, S-S- sternoscapularis, SS – subscapularis, ST – spinotrapezius, SV- serratus ventralis, SVC- serratus ventralis cervicis, TLOd – triceps brachii caput longum profundus, TLOs - triceps brachii caput longum superficialis, TMA – teres major, TMI – teres minor]

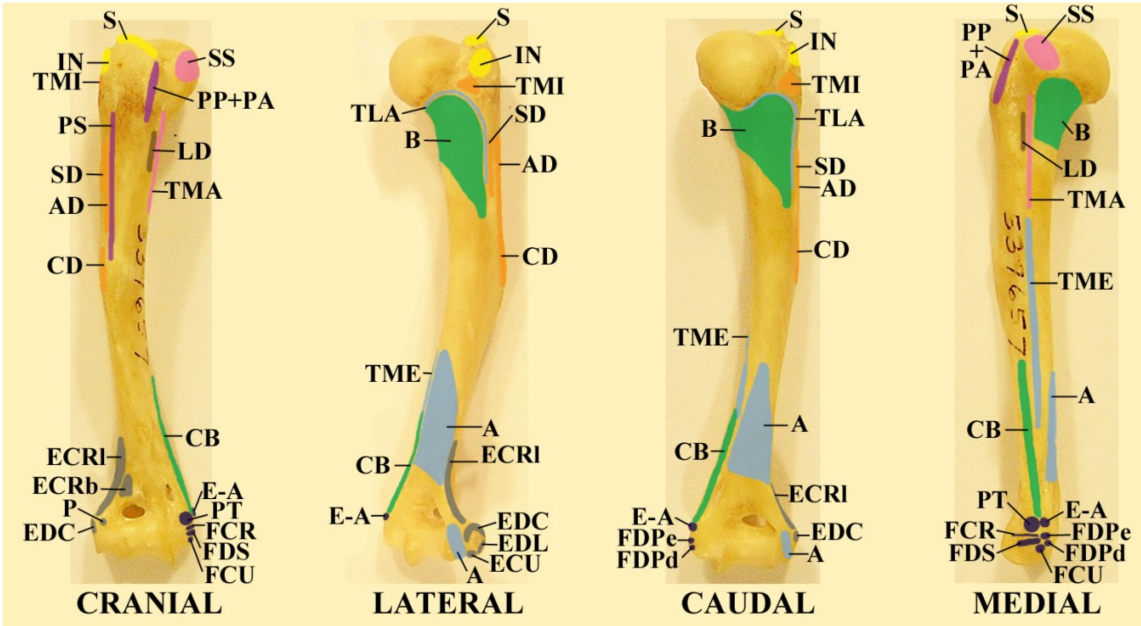


Figure 3.3C-22. Muscle attachment maps for the humerus.

[A- anconeus, AD- acromiodeltoideus, B- brachialis, CB- coracobrachialis, E-A- epitrochleo-anconeus, ECRb- extensor carpi radialis brevis, ECRl – extensor carpi radialis longus, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, FCR- flexor carpi radialis, FDPe- superficial portion of flexor digitorum profundus, FDPd- deep portion of flexor digitorum profundus, FDS – flexor digitorum superficialis, IN- infraspinatus, LD- latissimus dorsi, PP+PA- pectoralis profundus and pectoralis abdominalis, PS- pectoralis superficialis, PT- pronator teres, S- supraspinatus, SD- spinodeltoideus, SS- subscapularis, TLA- triceps brachii caput laterale, TMA- teres major, TME- triceps brachii caput mediale, TMI- teres minor]

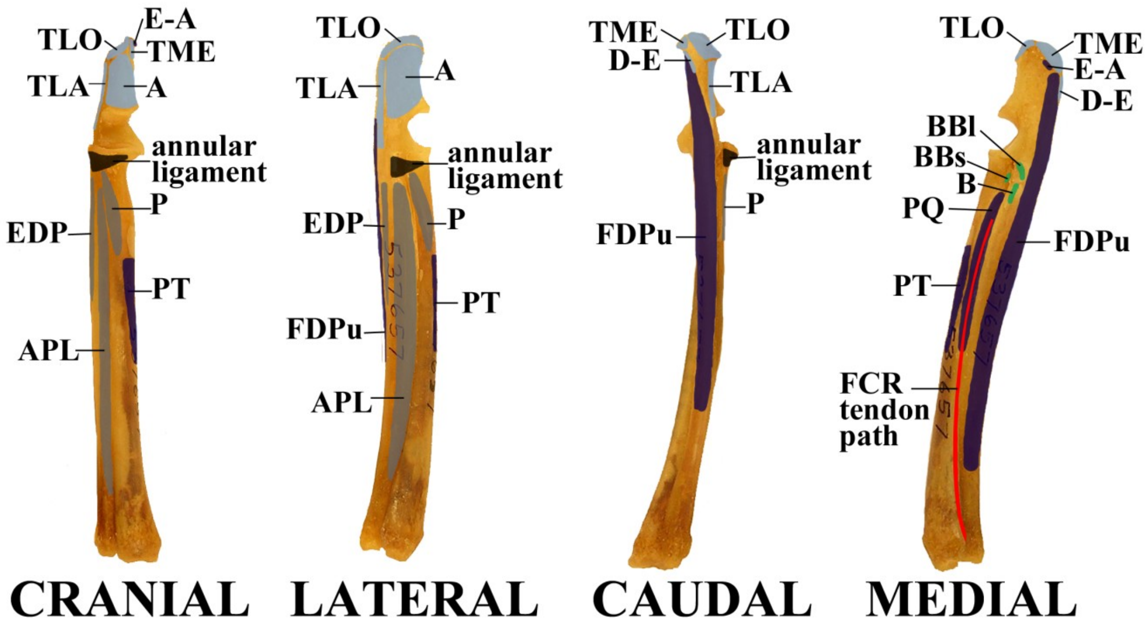


Figure 3.3C-23. Muscle attachment maps for the radius and ulna.

[A – anconeus, APL – abductor pollicis longus, B – brachialis, BBl – long head of biceps brachii, BBs – short head of biceps brachii, D-E – dorso-epitrochlearis, E-A – epitrochlear-anconeus, EDP – extensor digitorum profundus, FDPu – ulnar head of flexor digitorum profundus, P – supinator, PT – pronator teres, PQ – pronator quadratus, TLA – triceps brachii caput laterale, TLO – triceps brachii caput longum TME – triceps brachii caput mediale]

3.4A - Hyracoidea – Procaviidae – *Procavia capensis*

Both Murie & Mivart (1865) and Windle & Parsons (1901) discussed the forelimb anatomy of *Procavia*. Fischer (1992) also mentioned and figured some important parts of the forelimb anatomy. The following description of the extrinsic and intrinsic muscles of the forelimb of a female specimen of *Procavia capensis*, the rock hyrax (Hyracoidea, Procaviidae), is generally in agreement with previous descriptions. The specimen was collected for the American Museum of Natural History in Sudan in 1927. Externally the specimen appears to be in excellent condition, but upon skinning, a multitude of shots and sand were found lodged in the skin. There was some damage to the superficial layer of neck and shoulder muscles, and the tissues were dry. Despite this, the specimen was quite usable. The forearm and palm were dissected with aid of a microscope.

A. 

B. 

Figure 3.4A-1. Pre-dissection photographs of *Procavia capensis*, AMNH 82304.
A. Lateral view, left side. B. Ventral view. Ruler marks 15 cm.

0. CUTANEOUS MUSCULATURE

mm. sphincter colli, panniculus carnosus, dorsocutaneous

M. sphincter colli muscle is very mingled with m. clavotrapezius and they are quite difficult to separate. It encircles the neck and is quite robust when compared with m. sphincter colli of macroscelidids. M. dorsocutaneous is absent.

As stated by Murie & Mivart (1865: 335), m. panniculus carnosus is "an extensive sheet of muscular fibres, covering the whole back, the sides, and abdomen." It originates from the dorsal midline. It inserts cranially into the fascia covering the scapula. It is particularly adherent to the tough fascia covering the caudal surface of mm. triceps brachii and at this point of adhesion near the axilla some fibers merge with m. latissimus dorsi. Caudally, the thin sheet of muscle keeps the thigh and knee close to the body, and is fused to the inguinal region.

Figure 3.4A-2. Cutaneous musculature, lateral view, left side (P4023054).

A. TRAPEZIUS GROUP – ACCESSORY NERVE and CERVICAL NERVES

mm. sternomastoideus, cleidomastoideus, clavotrapezius, acromiotrapezius, spinotrapezius

M. sternomastoideus is 1 cm wide and originates from the ramus of the mandible and from the surface of the masseter. I did not see the additional portion originating from the paroccipital observed by Windle & Parsons (1901), which was perhaps obscured by the fibrosis in that region due to the shot wounds. M. sternomastoideus joins its partner to form a thick ventral raphe in the neck 4 cm long, and tapers to insert for 1.5 cm along the surface of the manubrium deep to m. pectoralis superficialis (Murie & Mivart, 1865; Windle & Parsons, 1901). Deep to m. sternomastoideus is a large salivary gland.

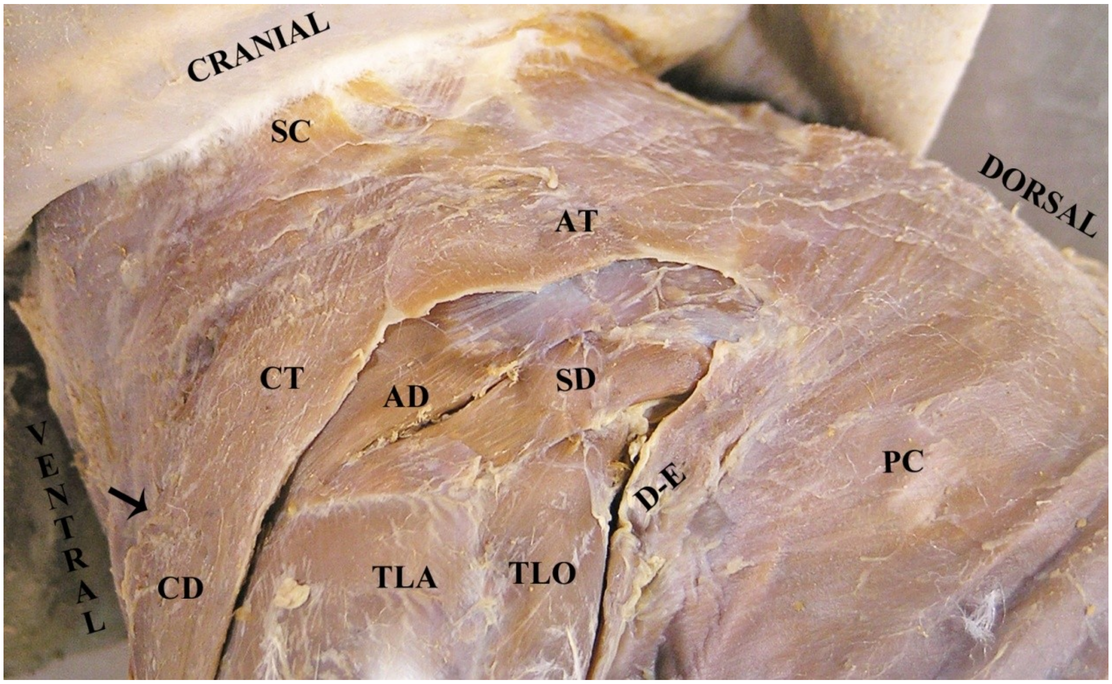
M. cleidomastoideus is completely hidden by m. sternomastoideus. It originates from the paroccipital process by slender tendinous fibers and inserts on the manubrium. Because of its unusual conformation, m. cleidomastoideus is not described correctly in the literature available for the Hyracoidea. Murie & Mivart (1865) seem to have confounded this muscle with m. omotransversarius in their description of "the third part of sterno-cleido-mastoid," as I did in my original notes. Upon reexamination of the specimen, however, I noticed the true m. cleidomastoideus completely hidden under m. sternomastoideus and realized that an additional belly of m. omotransversarius, as found in some other afrotheres, was the source of the confusion. Indeed, in many afrotheres m. cleidomastoideus inserts on the manubrium.

M. clavotrapezius is 1.5 cm wide and originates from the occipital crest. Its caudal edge is fused with the cranial edge of m. acromiotrapezius, although a tiny gap remains on their deep surface. M. clavotrapezius inserts at the location of the absent clavicle, a tendinous demarcation called the clavicular intersection. The ventral belly of

m. omotransversarius also inserts at the clavicular intersection, and m. clavodeltoideus originates at the clavicular intersection. Together, the three muscles form the compound muscle, “m. brachiocephalicus,” that caps the shoulder, forming a smooth band of muscle stretching from the cranium through the forearm.

M. acromiotrapezius is a thin sheet of muscle that originates for 2.5 cm along the ligamentum nuchae and the proximal three thoracic spinous processes. Murie & Mivart (1865) described an origin from the occiput, but in my specimen the origin very clearly does not extend to the cranium. Rather, it is conjoined with the caudal edge of m. clavotrapezius, which does originate from the cranium. After extending for 6 cm it inserts into the fascia along the glenoid end of the spine of the scapula, covering much of m. supraspinatus. Towards insertion it is also very closely applied to the dorsal belly of m. omotransversarius.

M. spinotrapezius is smaller than m. acromiotrapezius, at 1.8 cm wide and 2.5 cm long. It originates from thoracic spinous processes just caudal to m. acromiotrapezius and overlapping the cranial edge of m. latissimus dorsi, remaining distinct in its own fascial covering. M. spinotrapezius inserts into the base of the scapular spine and the fascia covering m. infraspinatus, hiding the origin of m. teres major.

A.


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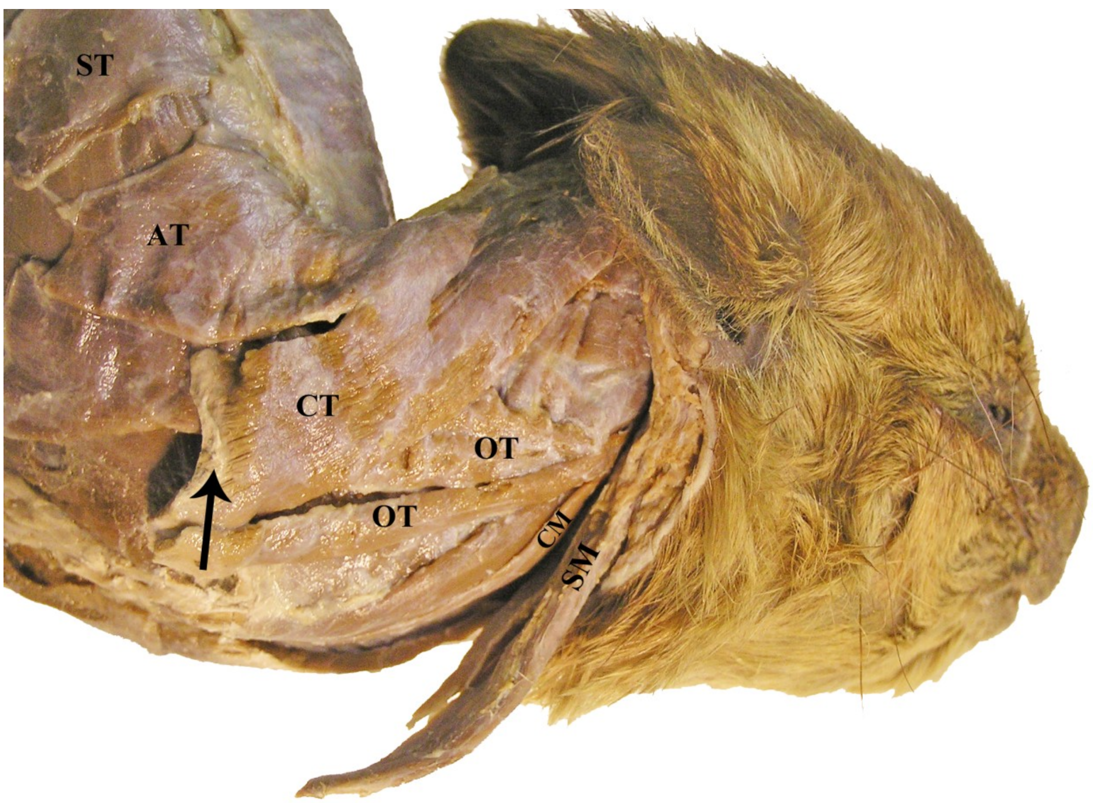


Figure 3.4A-3. Trapezius complex.

A. Superficial lateral view, left side (P9190023). Arrow marks location of clavicular intersection. B. Deep lateral view, forelimb removed, right side (P4023027). Arrow marks location of clavicular intersection.

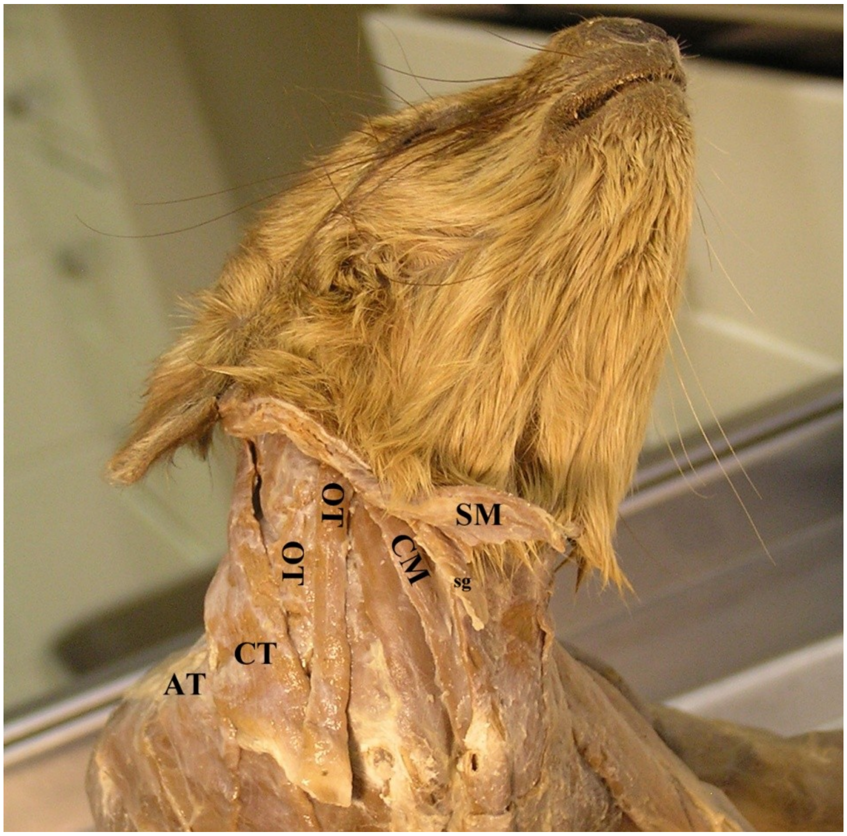
C. 

Figure 3.4A-3 continued. Trapezius complex. C. Deep ventral view, forelimb removed, right side (P4023037).

[AD- acromiodeltoideus, AT- acromiotrapezius, CD- clavodeltoideus, CM- cleidomastoideus, CT- clavotrapezius, D-E- dorso-epitrochlearis, OT- omotransversarius, PC- panniculus carnosus, SC- sphincter colli, sg – salivary gland, SM- sternomastoideus, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum]

B. RHOMBOID GROUP – DORSAL SCAPULAR NERVE

mm. rhomboideus capitis, rhomboideus cervicis, rhomboideus thoracis

M. rhomboideus capitis is a slim muscle originating from the occiput and inserting on the cranial border of the scapula near the angle.

M. rhomboideus cervicis is a robust sheet of muscle originating from the ligamentum nuchae and proximal thoracic vertebrae. It has a thick, fleshy insertion along the cartilage at the junction between the vertebral and cranial borders of the scapula, near the base of the spine. Here it abuts the insertion of mm. serratus ventralis cervicis et thoracis which is along the deep surface of the scapula.

M. rhomboideus thoracis originates from the spine of the sixth thoracic vertebrae and inserts just lateral to the insertion of m. serratus ventralis thoracis into the cartilaginous portion of the caudal angle of the scapula. Murie and Mivart (1865) observed m. rhomboideus cervicis from the sixth thoracic vertebra and m. rhomboideus thoracis originating from the spines of the sixth through tenth thoracic vertebrae.

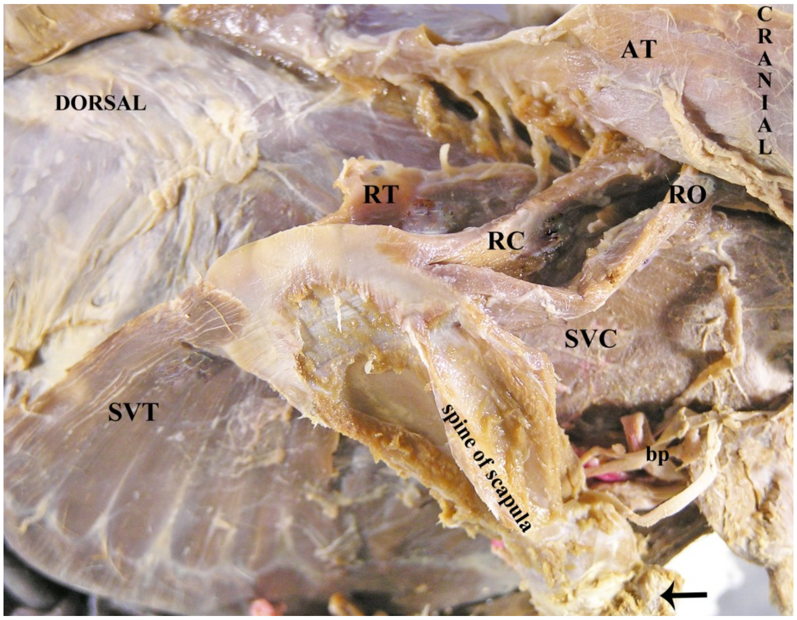


Figure 3.4A-4. Mm. rhomboideus and serratus ventralis, deep lateral view (PA200011).

Arrow marks greater tuberosity of humerus.

[AT- acromiotrapezius (reflected), bp- brachial plexus, RC- rhomboideus cervicis, RO- rhomboideus capitis, RT- rhomboideus thoracis, SVC- serratus ventralis cervicis, SVT- serratus ventralis thoracis]

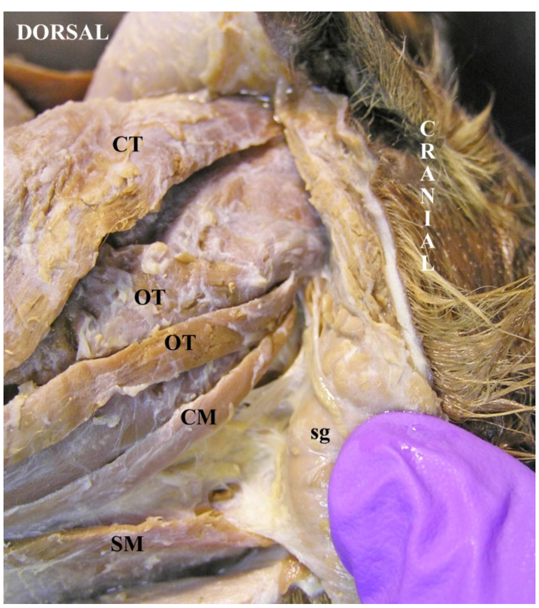


Figure 3.4A-5. Mm. omotransversarius, deep lateral view of origins (P3162841).

[CM- cleidomastoideus, CT- clavotrapezius, OT- omotransversarius, sg- salivary gland, SM- sternomastoideus]

C. OMO GROUP – CERVICAL NERVES, LONG THORACIC NERVE

mm. omotransversarius, omohyoideus, serratus ventralis (cervicis, thoracis)

M. omotransversarius was damaged in the specimen, due to a shot wound near the shoulder. Despite this issue, I believe that there are two bellies of m. omotransversarius, similar to those found in Chrysochloridae and my interpretation of the anatomy of Proboscidea and Sirenia. The origin of the dorsal belly of m. omotransversarius was by mixed fleshy and tendinous fibers from the transverse process of the third cervical vertebrae. The muscle broadens and is closely applied to m. acromiotrapezius at its insertion into the fascia over m. infraspinatus. Proximally, the 5 mm wide ventral belly of m. omotransversarius is deep to mm. sternomastoideus, clavotrapezius, and acromiotrapezius. It originates from the transverse process of the atlas dorsal to the origin of m. cleidomastoideus and inserts into the clavicular intersection deep to m. clavotrapezius, joining with its deep surface to form "m. brachiocephalicus."

M. omohyoideus is absent (Murie & Mivart, 1865; Windle & Parsons, 1901).

M. serratus ventralis cervicis originates from the transverse processes of the third to seventh cervical vertebrae and from the proximal five ribs. M. serratus ventralis thoracis slightly overlaps the edge of m. serratus ventralis cervicis where it originates from ribs 5-11. The two muscles are joined and this huge muscular sheet attaches at the caudal angle of the scapula and on the deep surface of the scapula along the entire length of the vertebral border.

D. DELTOID GROUP – AXILLARY NERVE

mm. clavodeltoideus, acromiodeltoideus, spinodeltoideus, teres minor

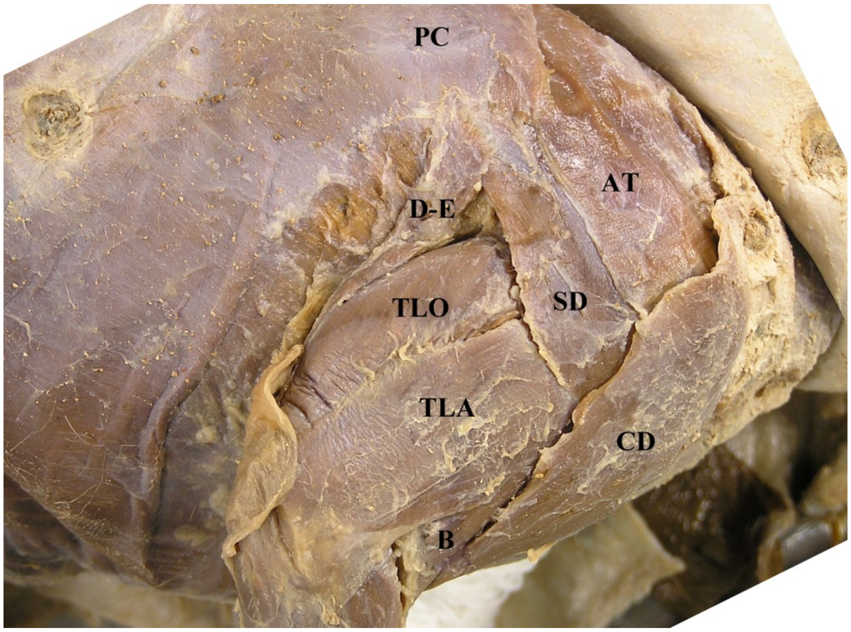
On the underside of "m. brachiocephalicus" is a shiny tendinous band, clearly demarcating the clavicular intersection and the origin of m. clavodeltoideus. M. clavodeltoideus is broad and flat and caps the shoulder. It inserts on the medial ulna superficial to the insertion of m. brachialis.

M. acromiodeltoideus is fused with m. spinodeltoideus on the right side of the specimen, but a division is visible on the left side. The two muscles are nearly fused in *Heterohyrax*. Murie & Mivart (1865) found m. acromiodeltoideus was much smaller than m. spinodeltoideus and originated from the greater tuberosity of the humerus and inserted medial to m. spinodeltoideus.

M. spinodeltoideus is a thin, rectangular muscle originating from the fascia covering the caudal border of m. infraspinatus and the middle of the spine of the scapula. It inserts onto the lateral edge of the proximal first centimeter of the delto-pectoral crest.

The axillary nerve emerges from between mm. triceps brachii caput longum and triceps brachii caput laterale. One branch fans out into the underside of m. spinodeltoideus while another large branch of the nerve travels deep to m. spinodeltoideus to emerge on its cranial border and enter m. clavodeltoideus muscle.

M. teres minor originates on the caudal border of the scapula, the tough fascia over m. triceps brachii caput longum, and the neck of the scapula. At its insertion on the greater tuberosity it is covered by m. infraspinatus. Murie and Mivart (1865) describe the muscle as being "intimate" with m. triceps brachii caput longum, but I noted no fleshy connection between them. M. teres minor is also innervated by the axillary nerve.

A. 

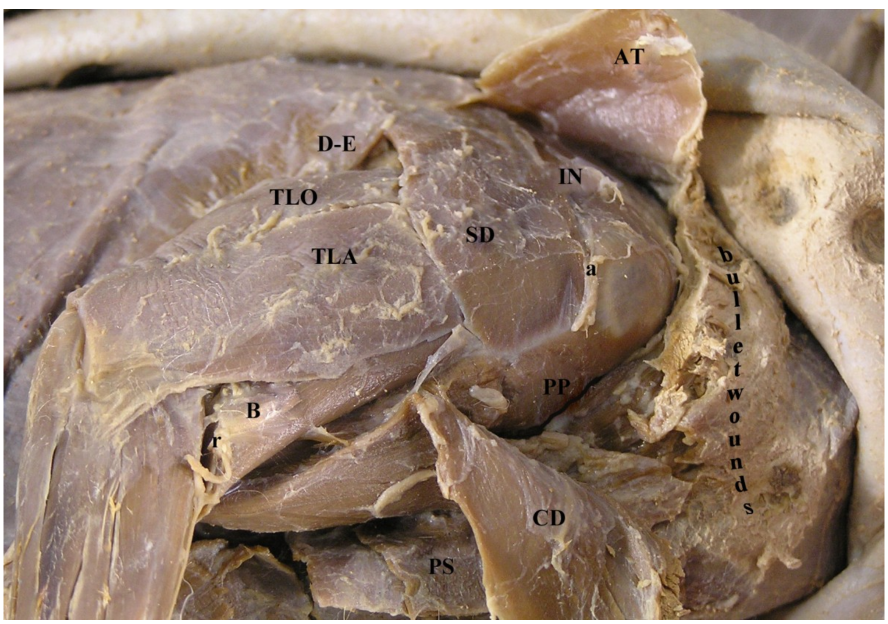
B. 

Figure 3.4A-6. Mm. deltoideus.
A. Superficial lateral view (P9180013). B. Deep lateral view, "m. brachiocephalicus" transected (P9280008).

[a- axillary nerve, AT- acromiotrapezius, B- brachialis, CD- clavodeltoideus, D-E- dorso-epitrochlearis, IN- infraspinatus, PC- panniculus carnosus, PP- pectoralis profundus, PS- pectoralis superficialis, r- radial nerve, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum]

E. SUBSCAPULARIS GROUP – SUBSCAPULAR NERVE
mm. subscapularis, teres major

M. subscapularis does not originate from the whole subscapular fossa, as mm. serratus ventralis thoracis et cervicis inserts on the deep surface of the vertebral border of the scapula. The muscle inserts along the entire caudal surface of the lesser tuberosity.

M. teres major has a large, fleshy origin at the caudal angle of the scapula. It joins with the distal part of m. latissimus dorsi and a small associated slip of m. panniculus carnosus before inserting mixed fleshy and tendinous fibers into the humerus just medial to the bicipital groove and the insertion of m. coracobrachialis.

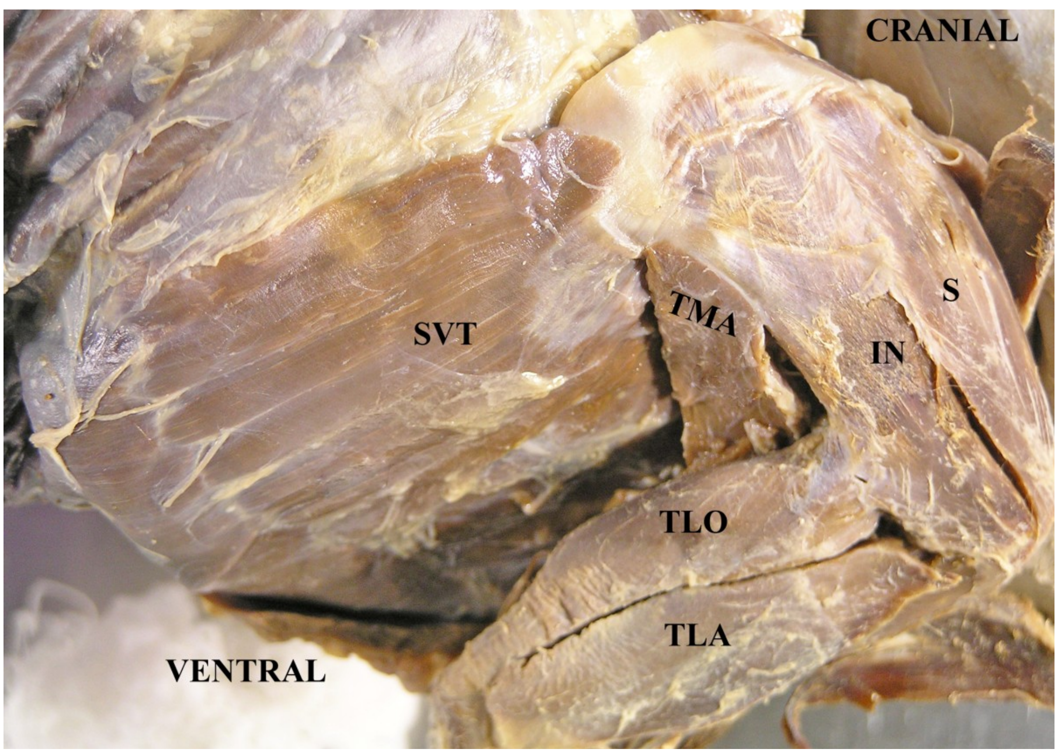


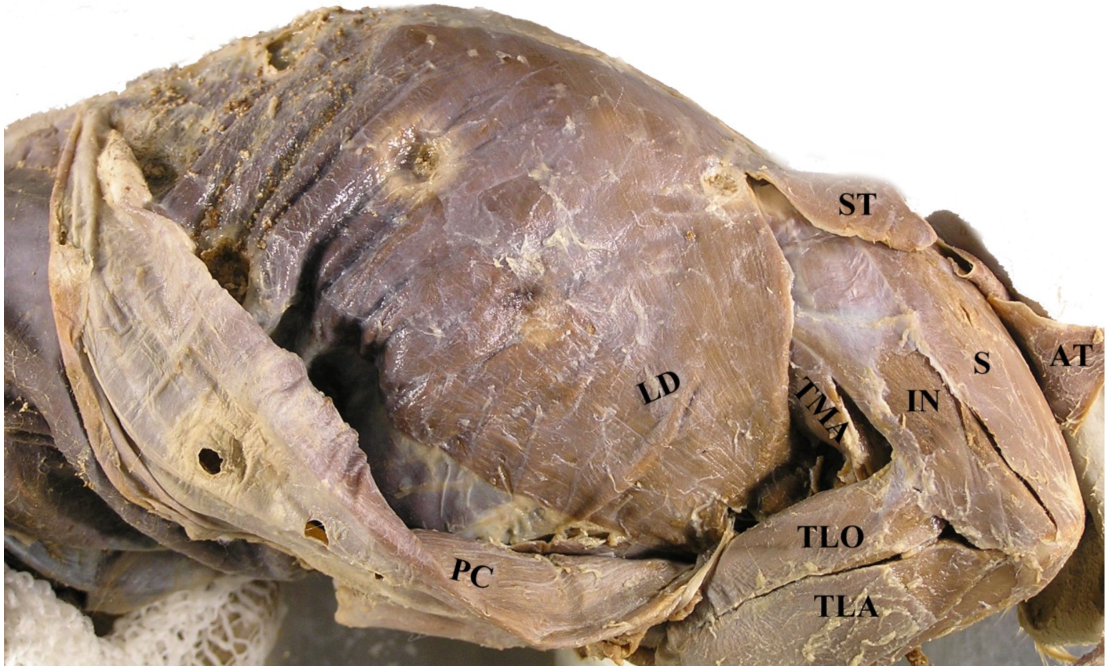
Figure 3.4A-7. Mm. teres major and serratus ventralis thoracis, lateral view (PA160005).

[IN- infraspinatus, S- supraspinatus, SVT- serratus ventralis thoracis, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, TMA- teres major]

F. LATISSIMUS GROUP – THORACODORSAL NERVE

m. latissimus dorsi

M. latissimus dorsi originates as a broad sheet of muscle from the thoracolumbar fascia along thoracic vertebrae 12-20, deep to the origin of m. spinotrapezius. It thickens as it sweeps under the axilla, and then divides into three parts. Murie and Mivart's (1865) description of the muscle is virtually identical except that they note only two parts, which seem to be the lateral and middle portions. The most lateral part comprises the great majority of the muscle, which fuses stoutly with m. teres major and part of m. panniculus carnosus to insert onto the humerus just medial to, and somewhat covered by, the insertion of m. coracobrachialis. The middle part is quite slender and a very thin piece of m. panniculus carnosus is rolled up into its medial border. It is attached to the aponeurosis covering m. biceps brachii. The medial part is an extremely thin slip that travels medially to the brachial plexus and joins up with m. pectoralis profundus.

A.


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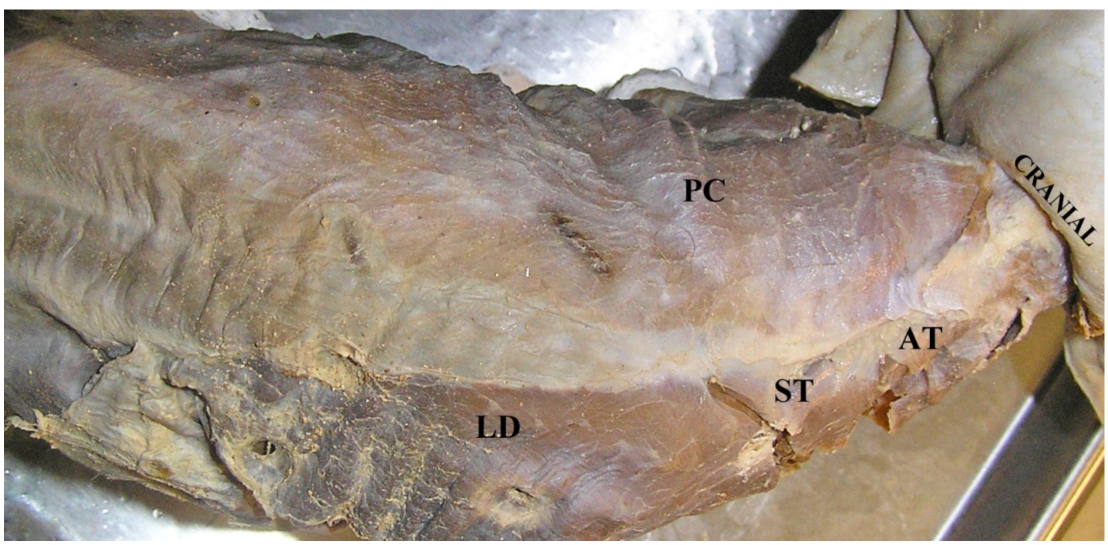


Figure 3.4A-8. M. latissimus dorsi.

A. Lateral view (PA150011). B. Dorsal view (P9232070).

[AT- acromiotrapezius, IN- infraspinatus, LD- latissimus dorsi, PC- panniculus carnosus, S- supraspinatus, ST- spinotrapezius, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, TMA- teres major]

G. PECTORALS GROUP – PECTORAL NERVES

mm. pectoralis superficialis, pectoralis profundus, pectoralis abdominalis, subclavius, sternoscapularis

M. pectoralis superficialis is a broad but very thin sheet of muscle divided into two partially overlapping, but fully divisible, layers of muscle. The superficial layer of m. pectoralis superficialis arises as a very thin sheet from the cranial end of the sternum and is the smaller of the two layers in *Procavia*. It inserts on the proximal third of the delto-pectoral crest. The deep layer of m. pectoralis superficialis arises from the middle of the sternum, immediately deep to the superficial layer, which overlaps it by half. The fibers run caudo-laterally to insert onto the distal half of the delto-pectoral crest just medial to the insertion of the superficial layer. Murie & Mivart (1865) did not find two layers of m. pectoralis superficialis.

M. pectoralis profundus originates by fleshy fibers from the xipisternum and ribs 4 - 6, with its caudal fibers integrated into m. pectoralis abdominalis and fused with it along the ventral midline. A large, smooth slip from m. pectoralis abdominalis and a very thin slip from m. latissimus dorsi join the muscle. The muscle inserts along the proximal part of the delto-pectoral crest just medial to the insertion of mm. deltoideus and just lateral to the belly of m. biceps brachii.

M. pectoralis abdominalis originates from m. external oblique caudo-lateral to the origin of m. pectoralis profundus. A deeper slip inserts into the lesser tuberosity of the humerus, and another more superficial slip of the muscle joins with the caudal border of m. pectoralis profundus and inserts at the greater tuberosity of the humerus.

Murie & Mivart (1865) state m. subclavius is absent, but it might be fused with m. sternoscapularis, which unfortunately was damaged by shot making this impossible to determine. M. sternoscapularis arises from the sternum proximal to the origin of m. pectoralis profundus. At its origin the muscle is quite thick but it flattens as it passes over the gleno-humeral joint and inserts into the tough fascia over m. supraspinatus and a small portion of the cranial angle of the scapula.

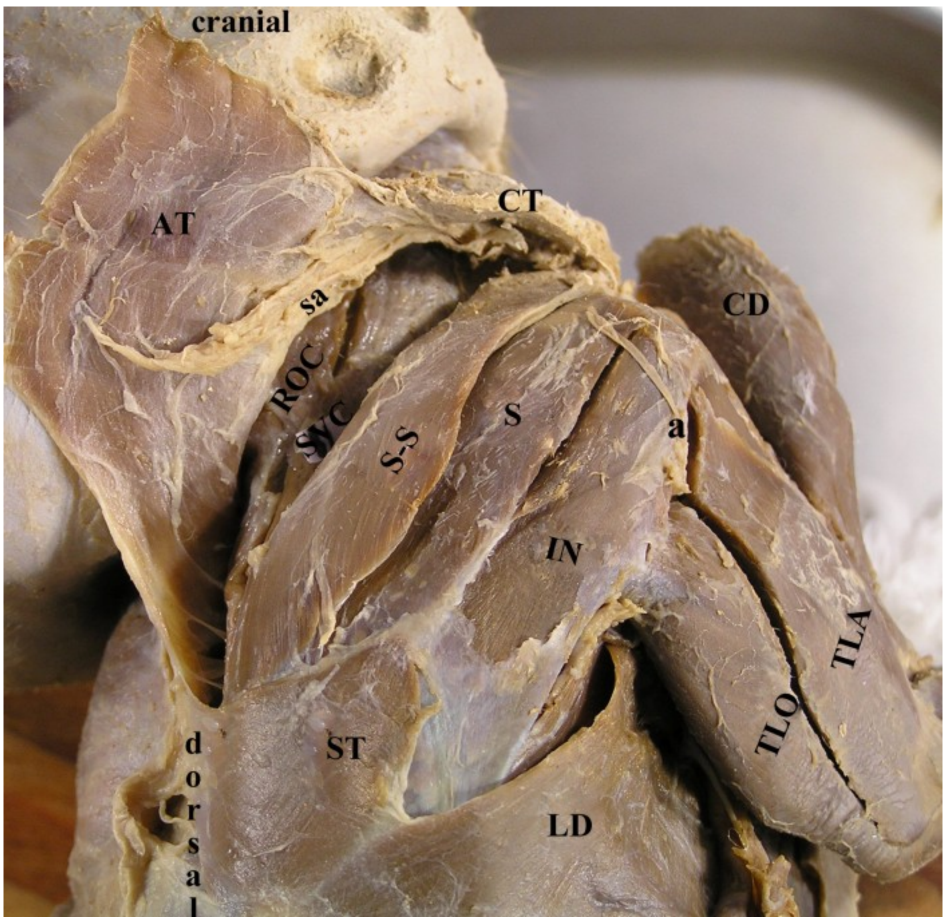


Figure 3.4A-9. M. sternoscapularis, dorsal view (PA030002).

[a- axillary nerve, AT- acromiotrapezius, CD- clavodeltoideus, CT- clavotrapezius, IN- infraspinatus, LD- latissimus dorsi, ROC- rhomboideus capitis and rhomboideus cervicis, S- supraspinatus, S-S- sternoscapularis, sa- spinal accessory nerve, ST- spinotrapezius, SVC- serratus ventralis cervicis, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum]

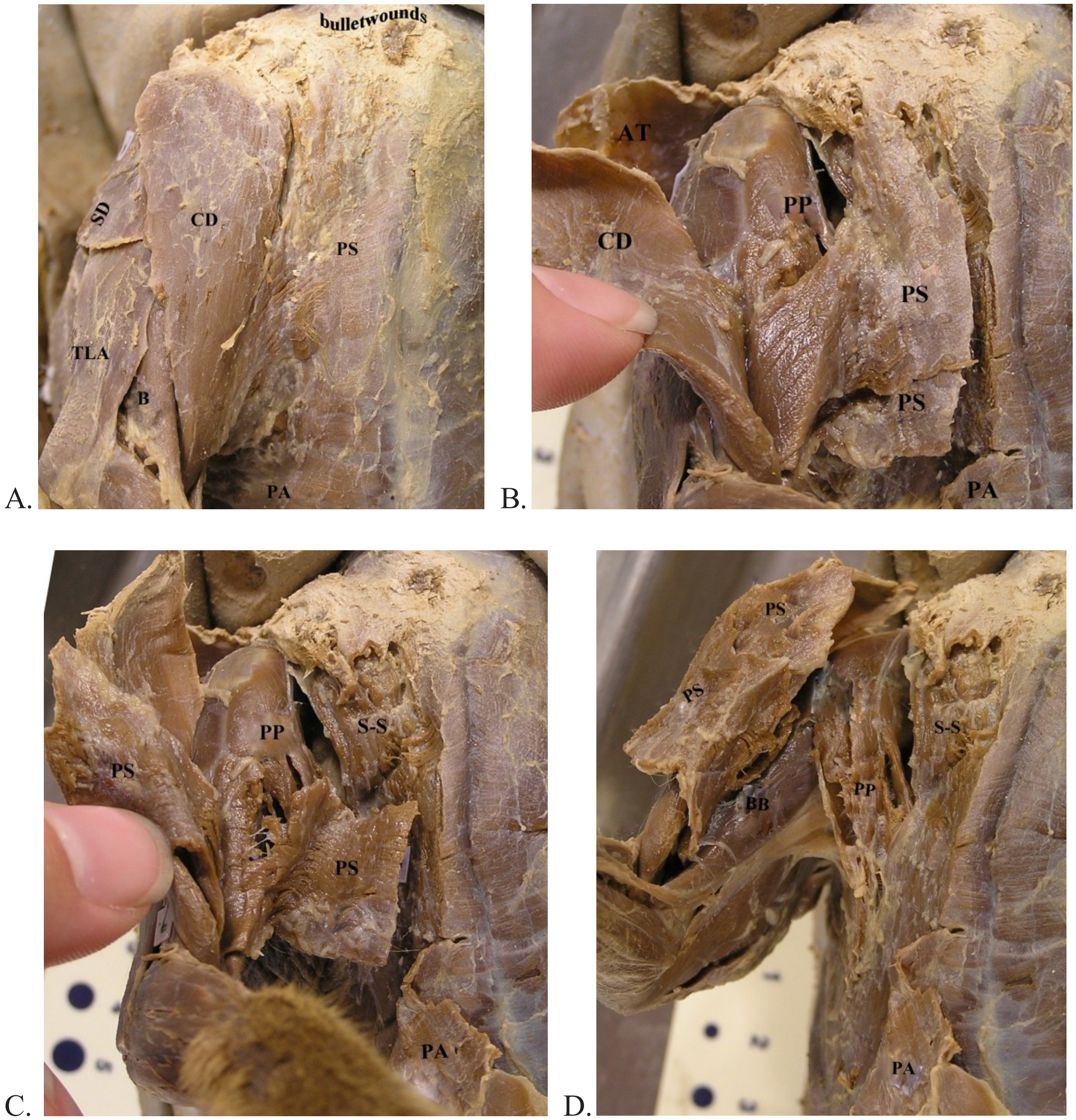


Figure 3.4A-10. Mm. pectoralis, ventral view.

A. Mm. pectoralis intact (P9180015). B. M. clavodeltoideus reflected showing insertion of superficial portion of m. pectoralis superficialis (P9280003). C. Deep portion of m. pectoralis superficialis (P9280004). D. Mm. pectoralis profundus and sternoscapularis (P9280007).

[AT- acromiotrapezius, B- brachialis, BB- biceps brachii, CD- clavodeltoideus, SD- spinodeltoideus, PA- pectoralis abdominalis, PP- pectoralis profundus, PS- pectoralis superficialis, S-S- sternoscapularis, TLA- triceps brachii caput laterale]

H. BICEPS GROUP – MUSCULOCUTANEOUS NERVE

mm. coracobrachialis, biceps brachii, brachialis, cubitalis

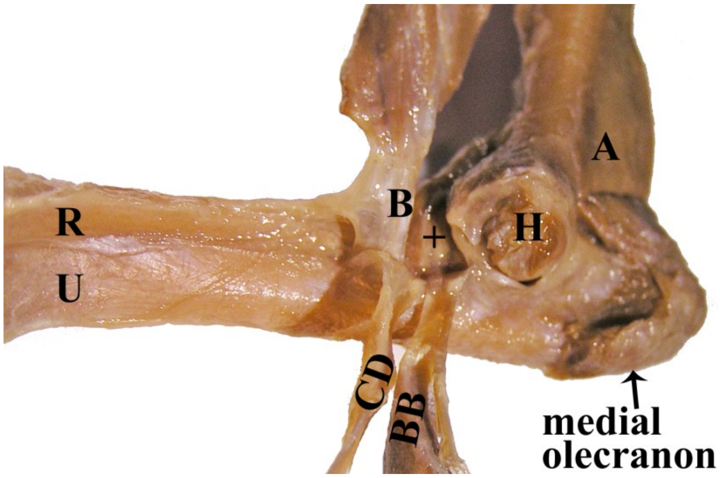
M. coracobrachialis originates from the coracoid process of the scapula and inserts in a line along the medial side of the bicipital groove, from the lesser tuberosity down to the middle of the humeral shaft. Just medial to the muscle is the combined insertion of mm. teres major and latissimus dorsi.

The delicate m. biceps brachii has a single tendon of origin from the glenoid and gleno-humeral joint capsule. The belly lies along the bicipital groove of the humerus just medial to the delto-pectoral crest and the insertion of m. pectoralis superficialis, and just lateral to the insertions of m. coracobrachialis and combined mm. teres major and latissimus dorsi. It inserts proximal to mm. brachialis and clavodeltoideus into a rugosity on the medial ulna just below the elbow joint. The musculocutaneous nerve pierces and innervates both mm. coracobrachialis and biceps brachii.

M. brachialis originates around the caudal aspect of the neck of the humerus, from the lateral edge of the greater tuberosity just distal to the origin of m. triceps brachii caput laterale. It has a small connection with m. pronator teres on the radius. The majority of the muscle inserts on the medial ulna deep to m. clavodeltoideus.

There is a thin slip of muscle originating from the cranial surface of the humerus at midshaft and inserting just proximal to the insertion of m. biceps brachii on the medial ulna. This extra muscle in the cranial arm, here named m. cubitalis, I also observed in *Heterohyrax*, *Calcochloris*, and *Microgale,* and possibly it is found in Sirenia (Domning, 1977, 1978) and *Elephas* (Miall & Greenwood, 1878).

A.



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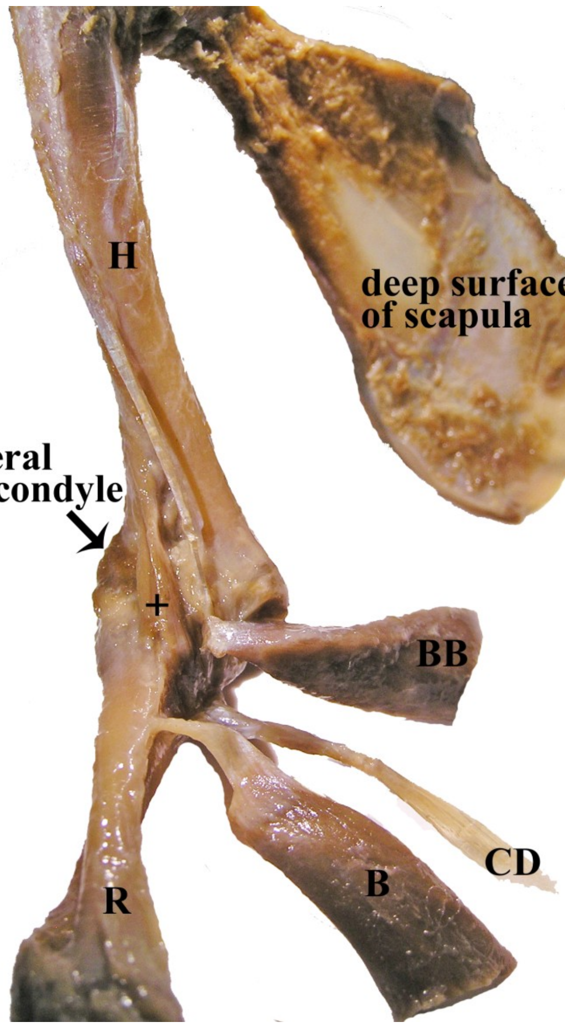


Figure 3.4A-11. Insertions of mm. of the biceps group. A. Medial view (P7113547). B. Cranial view (P7173743).

[+ cubitalis, A- anconeus, B- brachialis, BB- biceps brachii, CD- clavodeltoideus, H- humerus, R- radius, U- ulna]

I. SPINATI GROUP – SUPRASCAPULAR NERVE

mm. supraspinatus, infraspinatus

M. supraspinatus originates from the supraspinous fossa of the scapula but is large and projects above the cranial border. It is fleshy throughout and inserts into the medial side of the greater tuberosity of the humerus and the lateral edge of the bicipital groove.

M. infraspinatus originates from the infraspinous fossa, encased in a tough, shiny, white fascia. Fleshy fibers attach the muscle along the caudal border of the scapula, but then it becomes tendinous to pass over the scapular origin of m. teres minor before inserting into the greater tuberosity.

J. TRICEPS GROUP – RADIAL NERVE

mm. dorso-epitrochlearis, triceps brachii (caput laterale, caput mediale, caput longum), anconeus

M. dorso-epitrochlearis originates from the caudal edge of m. latissimus dorsi and partially from m. panniculus carnosus near m. infraspinatus. Murie & Mivart (1865) believed the origin to be from m. infraspinatus, but the only connection I observed was a small triangular pocket of fatty and lymphoid tissue over mm. infraspinatus and triceps brachii caput longum. The elongate muscle is fusiform near its origin but flattens before inserting into the medial olecranon.

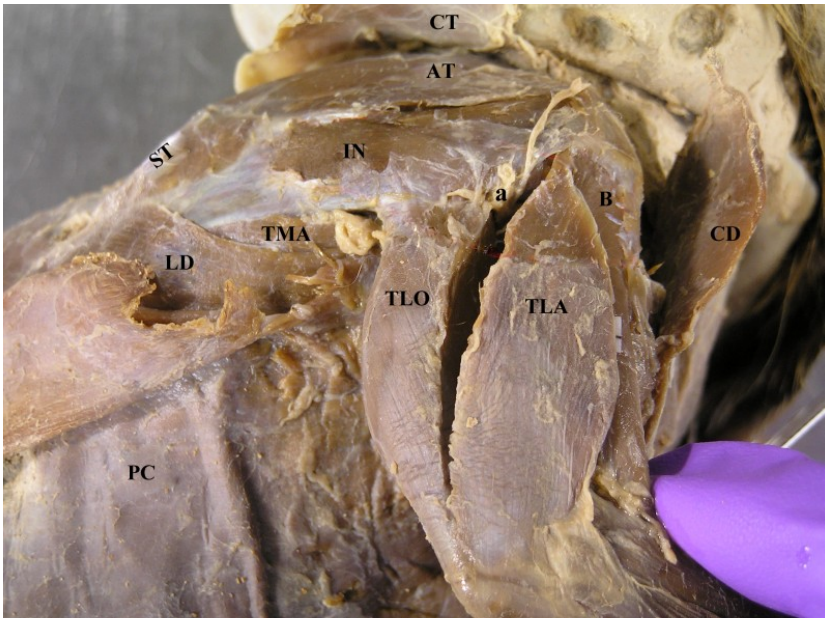
As in Tubulidentata and Macroscelidea, there are four heads to the triceps brachii: lateral, medial, and two scapular heads. Murie & Mivart (1865) also reported four portions of mm. triceps brachii in *Procavia*, but one of the portions they discussed is actually m. anconeus. They did not note the division of the scapular portions of triceps observed by Windle & Parsons (1901).

M. triceps brachii caput laterale is triangular in cross section and is covered at its origin by m. teres minor. It has a fleshy line of origin on the neck of the humerus just distal and caudal to the greater tuberosity. It inserts into the triceps aponeurosis along the lateral and caudal part of the olecranon and the lateral epicondyle of the humerus.

M. triceps brachii caput mediale originates on the medial aspect of the humerus from the neck and proximal third of the shaft, and inserts on the medial side of the olecranon. The proximal end of the muscle is covered by m. brachialis.

M. triceps brachii caput longum is in fact two heads which are very closely applied and bound together in fascia but separated by a large branch of the radial nerve. These two heads are here named m. triceps brachii caput longum superficialis and m. triceps brachii caput longum profundus. The two heads originate in a line along the anterior third of the caudal border of the scapula, separating the origins of mm. teres major and teres minor, and they also originate from the tough tissue surrounding m. infraspinatus. Halfway down their length, the two portions of m. triceps brachii caput longum fuse strongly before inserting into the tip of the olecranon.

M. anconeus is a substantial muscle. It originates from the caudal surface of the humeral shaft for over two-thirds of its length, and inserts onto the whole of the cranial surface of the olecranon and caudal surface of the lateral epicondyle.

A. 

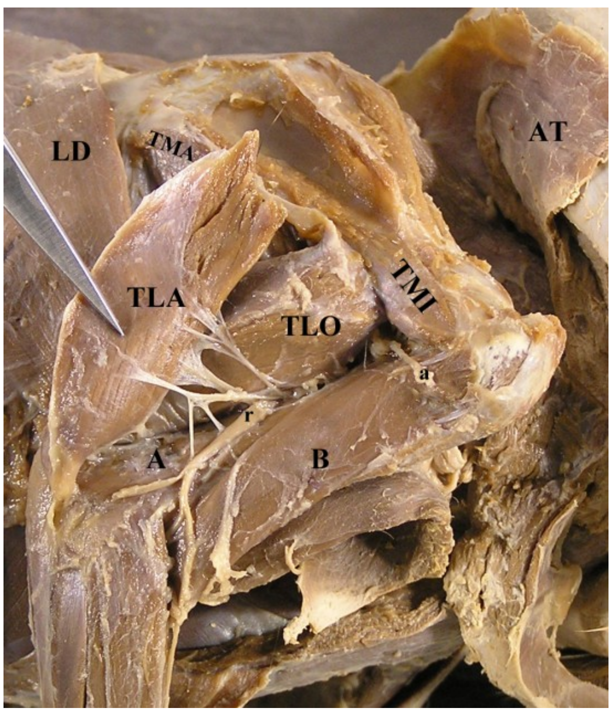
B. 

Figure 3.4A-12. Mm. triceps brachii.

A. Lateral view after removal of mm. deltoideus (PA020012). B. Deep lateral view after reflection of m. triceps brachii caput laterale (PA180006).

[a- axillary nerve, AT- acromiotrapezius, B- brachialis, CD- clavodeltoideus, CT- clavotrapezius, IN- infraspinatus, LD- latissimus dorsi, PC- panniculus carnosus, ST- spinotrapezius, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, TMA- teres major, TMI- teres minor]

Figure 3.4A-13. Mm. anconeus [A] and cubitalis [+], lateral view.

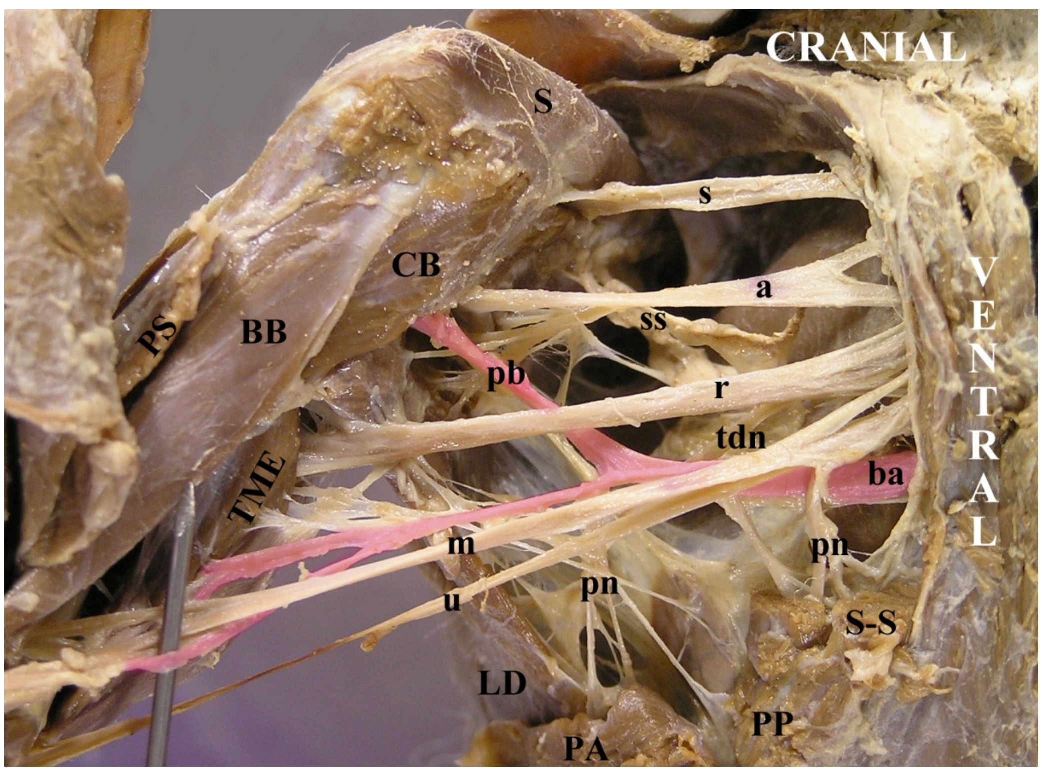


Figure 3.4A-14. Brachial plexus, ventral view (PA050004).

[a- axillary nerve, ba- brachial artery, BB- biceps brachii, CB- coracobrachialis, LD- latissimus dorsi, m- median nerve, PA- pectoralis abdominalis, pb- profunda brachii, pn- pectoral nerves, PP- pectoralis profundus, PS- pectoralis superficialis, r- radial nerve, s- suprascapular nerve, S- supraspinatus, S-S- sternoscapularis, ss- subscapular nerve, tdn- thoracodorsal nerve, TME- triceps brachii caput mediale, u- ulnar nerve]

K. EXTENSOR GROUP – RADIALNERVE

mm. brachioradialis, extensors carpi radialis longus et brevis, extensor digitorum communis, extensor digitorum lateralis, extensor carpi ulnaris, supinator, abductor pollicis longus, extensor digitorum profundus

M. brachioradialis is absent.

M. extensor carpi radialis is comprised of two bellies. They both originate from the lateral supracondylar crest of the humerus, with m. extensor carpi radialis longus just lateral to m. extensor carpi radialis brevis and both muscles just cranial to the origin of m. extensor digitorum communis. The two bellies are of approximately equal size and become tendinous at the level of the carpus. M. extensor carpi radialis longus inserts onto the base of metacarpal II while m. extensor carpi radialis brevis inserts onto the base of metacarpal III.

M. supinator is absent. M. supinator was also not observed in *Procavia* by Murie & Mivart (1865) and is absent in my specimen of *Heterohyrax*, however, Windle & Parsons (1901) describe "supinator brevis" inserting with m. abductor pollicis longus.

M. extensor digitorum communis has a large fleshy origin from a small tubercle on the lateral epicondyle of the humerus between the origins for mm. extensor carpi radialis and extensor digitorum lateralis. The muscle separates into four fleshy bundles which become tendinous at the level of the carpus. The four tendons insert on the distal phalanges of digits II-V.

M. extensor digitorum lateralis originates on the distal lateral edge of the lateral epicondyle of the humerus just distal to the origin of m. extensor digitorum communis.

The slender muscle belly splits at the level of the ulna midshaft and then becomes tendinous after crossing over the carpus. The two tendons insert on the lateral side of the proximal phalanges of digits IV and V, passing deep to the tendons of m. extensor digitorum communis.

M. extensor carpi ulnaris originates from the distal edge of the lateral epicondyle of the humerus and from the humero-ulnar joint capsule, just inferior and slightly deep to the origin of m. extensor digitorum lateralis. The muscle becomes tendinous after crossing over the carpus, and the fairly stout tendon inserts into the head of metacarpal V.

M. abductor pollicis longus originates from a ridge on the distal two-thirds of the lateral side of the ulna, the midshaft of the radius, and the interosseous membrane. The fleshy portion of the muscle ends at the level of the carpus, where the tendon crosses abruptly over to insert into the trapezium and the rudiments of the pollex.

M. extensor digitorum profundus is absent or fused with m. abductor pollicis longus. Murie & Mivart (1865) also found the muscle lacking.

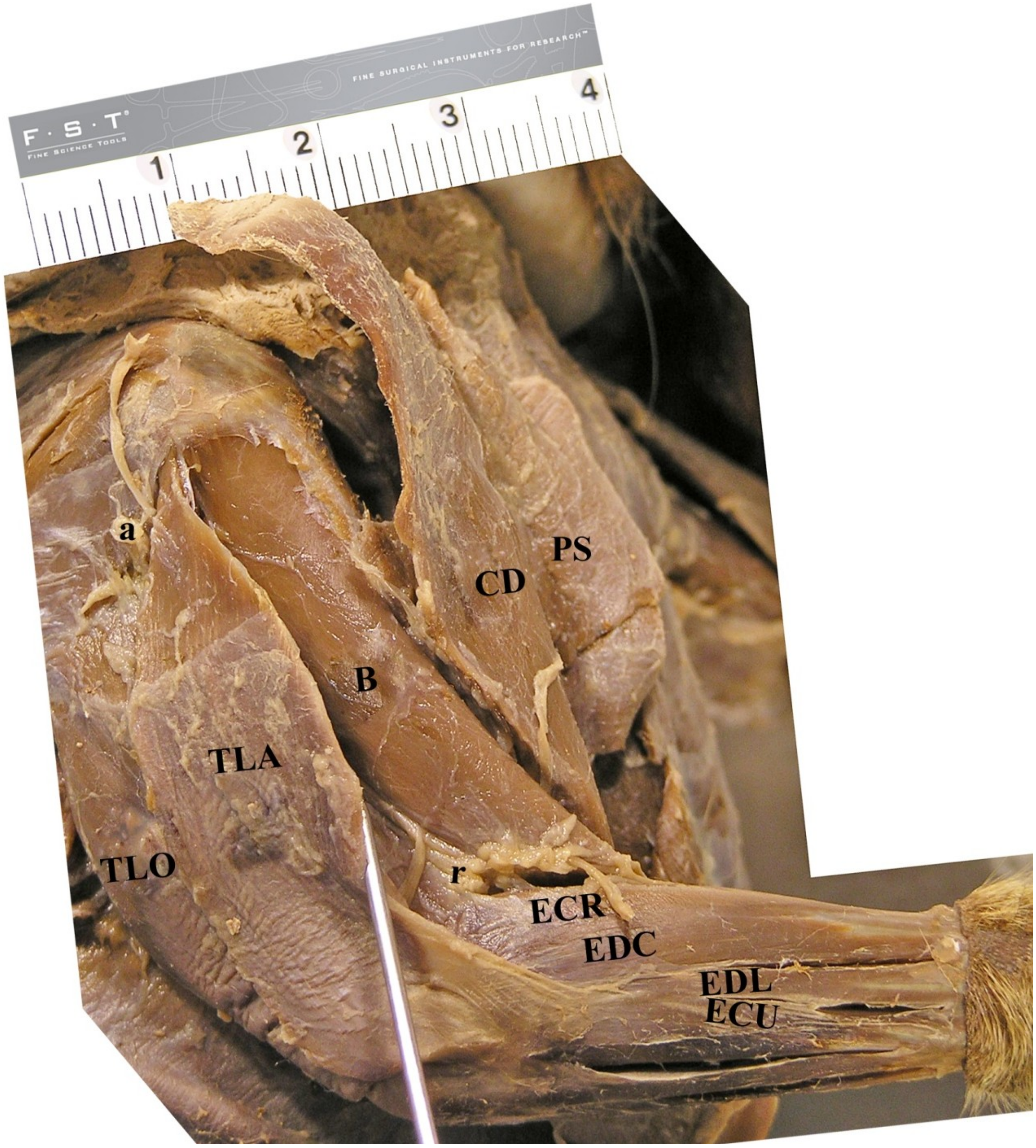


Figure 3.4A-15. Muscles originating from the lateral epidcondyle and radial nerve, lateral view (PA020009).

[a- axillary nerve, B- brachialis, CD- clavodeltoideus, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, PS- pectoralis superficialis, r- radial nerve, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum]

Figure 3.4A-16. M. extensor digitorum communis, cranio-lateral view (PB120002).

Figure 3.4A-17. M. extensor carpi radialis, cranial view (PB120005).

Figure 3.4A-18. M. abductor pollicis longus, cranial view (PB120012).

[A- anconeus, APL- abductor pollicis longus, B- brachialis, BB- biceps brachii, ECR- extensor carpi radialis, ECRb- extensor carpi radialis brevis, ECRl- extensor carpi radialis longus,ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extrensor digitorum lateralis, r- radial nerve]

L. FLEXOR GROUP – MEDIAN and ULNAR NERVES

mm. pronator teres^{m}, flexor carpi radialis^{m}, palmaris longus^{u}, flexor digitorum superficialis^{m}, flexor digitorum profundus^{m+u}, flexor carpi ulnaris^{u}, epitrochleo-anconeus^{u}, pronator quadratus^{m}

M. pronator teres originates on the medial epicondyle of the humerus just superior to the origin of m. flexor carpi radialis. It has a strong, triangular shaped, mixed tendinous and fleshy insertion on the distal third of the cranial side of the radius. Mivart & Murie (1865) stated that this muscle inserts onto the humerus, but I believe this is an error.

M. flexor carpi radialis originates from the medial epicondyle of the humerus, just distal to the origin of m. pronator teres and just proximal to the origin of m. palmaris longus. The very slender muscle becomes tendinous at the level of midshaft radius and travels along the distal radius and through a groove in the palmar surface of the base of vestigial metacarpal I. It inserts on the trapezium.

M. palmaris longus is quite bulky. It originates from the medial epicondyle of the humerus between the origins for m. flexor carpi ulnaris and the superficial epicondylar head of m. flexor digitorum profundus. The muscle remains fleshy until it forms the fibrocartilaginous palmar aponeurosis with slips to each of the four digits.

M. flexor digitorum superficialis originates from the flexor digitorum profundus; there is no distinct bony origin. At the level of the carpus it appears as three small bellies taking origin from the surface of the superficial epicondylar belly of m. flexor digitorum profundus. In the palm, it is perforated by the tendons of flexor digitorum profundus for digits III and IV and also has a belly inserting on digit V. This is unusual and possibly anomalous, as typically m. flexor digitorum superficialis forms perforated tendons for digits II-IV, which is what Murie & Mivart (1865) described for *Procavia* and is the condition of the muscle in *Heterohyrax*.

The median nerve travels through the cubital fossa, crossing deep to the origins of the flexors from the medial epicondyle. A branch travels between the three fasciculi of origin of m. flexor digitorum superficialis. After crossing into the carpus, the median nerve divides. The medial half sends a branch to m. flexor digitorum brevis profundus for digit II, then a tiny branch goes to the vestigial m. flexor digitorum brevis profundus for digit I, and the terminal branch supplies sensory innervation to the medial and lateral sides of digit II and the medial side of digit III. The lateral half supplies sensory innervation to the lateral side of digit III and the medial side of digit IV.

M. flexor digitorum profundus has three heads of origin: two from the medial epicondyle and one from the ulna. The superficial epicondylar belly of m. flexor digitorum profundus originates in a horizontal line on the cranial surface of the medial epicondyle. At the carpus, the three small bellies of m. flexor digitorum superficialis take origin from the surface of this muscle, which goes on to insert on the medial side of the conjoined flexor tendon. The deep epicondylar belly of m. flexor digitorum profundus has a mixed fleshy and tendinous origin, but it quickly becomes a fleshy belly. This belly is 2.5 cm long and then becomes a flat, thin translucent tendon which is only 5 mm long before it fuses with the surface of the conjoined flexor tendon. The ulnar belly of m. flexor digitorum profundus is substantial. Its 2 cm origin extends from the ridge along the medial olecranon nearly to the ulnar midshaft. There a large tendon forms medially, and just 1 mm proximal to the carpus, the fleshy belly ends and its tendon joins the broad conjoined flexor tendon and travels through the palm. Thus the distal tendons of all three heads of m. flexor digitorum profundus fuse to form a very strong conjoined flexor tendon. The conjoined flexor tendon is more than 1 mm thick where it crosses the carpus. It divides into four tendons which insert on the distal phalanges of digits II-V.

M. flexor carpi ulnaris is divided into two portions separated by the ulnar nerve. The ulnar belly has an extensive origin from the medial side of the olecranon process, on the crest marking the distal margin of the rugose area where mm. triceps brachii and dorso-epitrochlearis insert. Thus, the muscle belly fills the area bounded by this crest and the cranial border of the ulna. The humeral belly originates from the distal part of the medial epicondyle of the humerus. The two portions remain separate from their origin to the level of the carpus, where they fuse into a broad tendon just before inserting into the pisiform.

M. epitrochleo-anconeus is very tendinous, and extends from the medial epicondyle to the medial olecranon. This muscle is absent in *Heterohyrax* and Murie & Mivart (1865) did not describe it in *Procavia*.

M. pronator quadratus is represented only by a few shimmery fibers spanning the distal radius and ulna. A tiny branch of the anterior interosseous nerve adherent to the radius supplies these fibers.

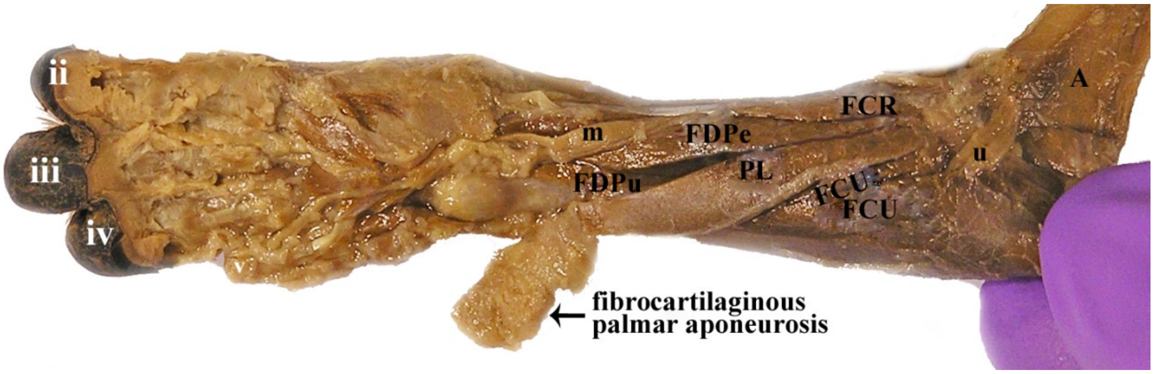


Figure 3.4A-19. Muscles originating from the medial epicondyle, medial view (PB130016).

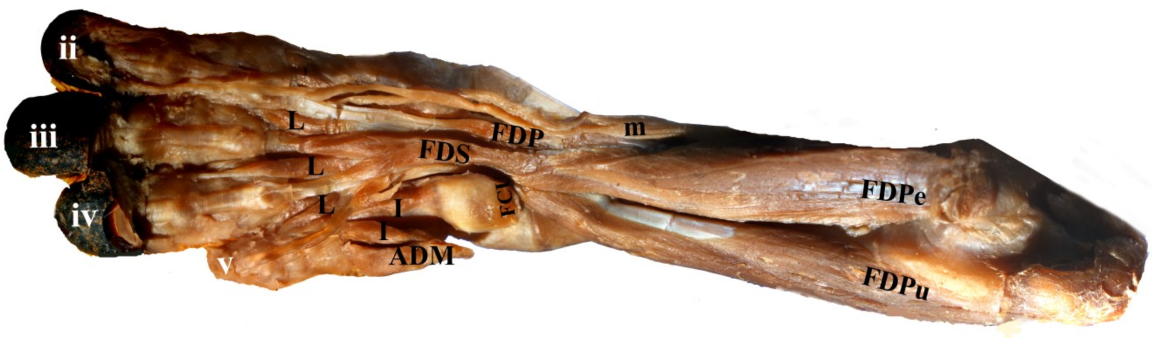


Figure 3.4A-20. Mm. flexor digitorum superficialis and profundus, medial view (P6190557).

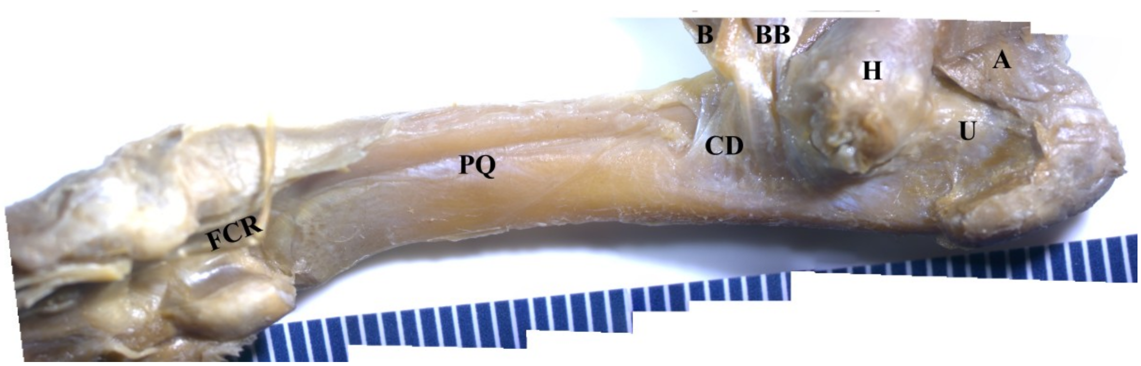


Figure 3.4A-21. M. pronator quadratus, medial view. Ruler lines mark 1 mm.

[A- anconeus, ADM- abductor digiti minimi, B- brachialis, BB- biceps brachii, CD- clavodeltoideus, FCR- flexor carpi ulnaris, FCU- flexor carpi ulnaris, FDPe- superficial epicondylar belly of flexor digitorum profundus, FDPu- ulnar belly of flexor digitorum profundus, H- humerus, I- flexor digitorum breves profundus, L- lumbricales, m- median nerve, PL- palmaris longus, PQ- pronator quadratus, U- ulna, u- ulnar nerve]

M. MANUS GROUP – MEDIAN and ULNAR NERVES

mm. palmaris brevis, flexor digitorum breves manus^{u}, lumbricales^{m+u}, abductor digiti minimi^{u}, contrahentes^{u}, abductor pollicis brevis, flexor breves profundus^{u}

M. palmaris brevis is absent in *Procavia.*

Mm. flexor digitorum breves manus is a fan-shaped muscle which originates from the fibrocartilaginous palmar aponeurosis. It forms three small fleshy bellies which have tendinous insertions onto digits II, IV, and V. The remnant of a belly for digit I is visible on the medial edge of the belly for digit II. Like m. flexor digitorum superficialis, the tendons of mm. flexor digitorum breves manus are perforated by the tendons of m. flexor digitorum profundus. The ulnar nerve sends a large branch to m. flexor digitorum brevis manus for digit V.

There are two mm. lumbricales in *Procavia capensis*, originating from the palmar surface of the broad conjoined tendon of m. flexor digitorum profundus. One originates between digits II and III and inserts on the lateral side of the proximal phalanx of digit III. The other originates between the tendons of digits III and IV and inserts on the medial side of the proximal phalanx of digit IV.

M. abductor digiti minimi is the largest and most lateral muscle of the manus and the more superficial of the two muscles originating from the strong fibrous fascia on the pisiform, and it inserts on the lateral side of the base of the proximal phalanx of digit V.

The pollex is vestigial, represented only by a tiny metacarpal I bound against the medial edge of the larger and functional metacarpal II, and m. abductor pollicis brevis is absent in *Procavia*.

There are three mm. contrahentes in the manus, which appear as flat triangles of muscle serving digits II, IV, and V. The lateral m. contrahens originates on the lateral edge of the ligaments binding the metacarpals together, and inserts on the medial side of the middle phalanx of digit V. The middle m. contrahens originates superficial to mm. flexor digitorum breves profundus for digits III and IV. It inserts via a thin tendon just distal to the insertion of the medial m. flexor digitorum brevis manus of digit IV. The medial m. contrahens originates superficial to the paired mm. flexor digitorum breves profundus for digit II and inserts on the lateral side of the proximal phalanx of digit II.

There are nine mm. flexor digitorum breves profundus. Mm. flexor digitorum breves profundus for the vestigial pollex are still present, however their insertions are unusual. The lateral muscle for digit I actually inserts on the medial side of metacarpal II, thus functioning more as an abductor of digit II, and the medial muscle, often known as "m. flexor pollicis brevis," is attached to the lateral side of metacarpal I. The paired mm. flexor digitorum breves profundus for digits II, III, and IV are deep to mm. contrahentes and originate from the strong ligaments over the carpals and proximal metacarpals. They insert into sesamoid bones on each side of the base of the proximal phalanx. The muscle originating from the pisiform, deep and medial to m. abductor digiti minimi, is m. flexor digitorum brevis profundus for digit V, often known as "m. flexor digiti minimi." The other m. flexor digitorum brevis profundus for digit V originates deeper still from the medial edge of the pisiform and along the lateral edge of the ligaments binding the metacarpals and carpals together.

The deep branch of the ulnar nerve sends a slip to mm. contrahentes and then supplies m. abductor digiti minimi. and mm. flexor digitorum breves profundus.

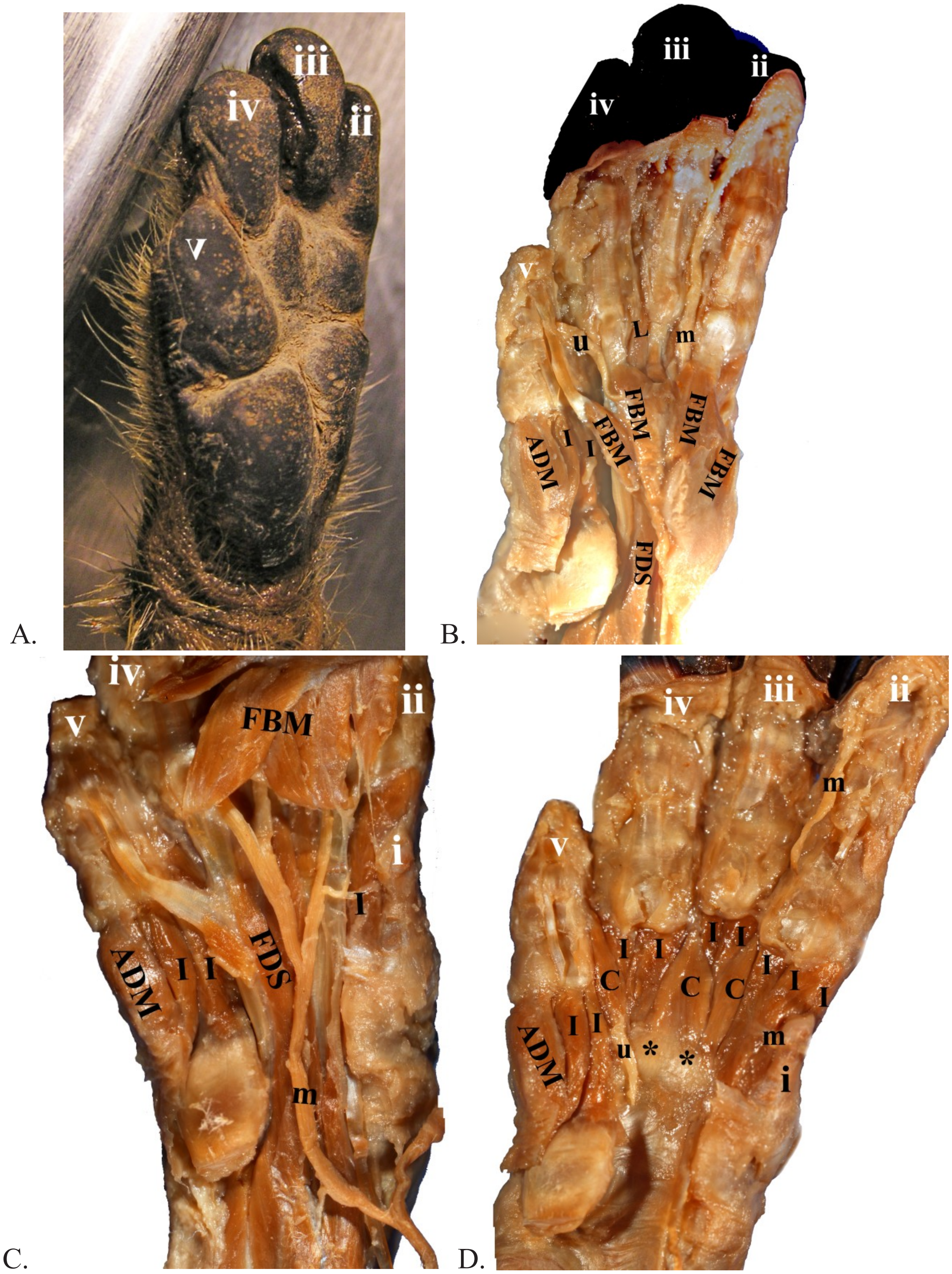
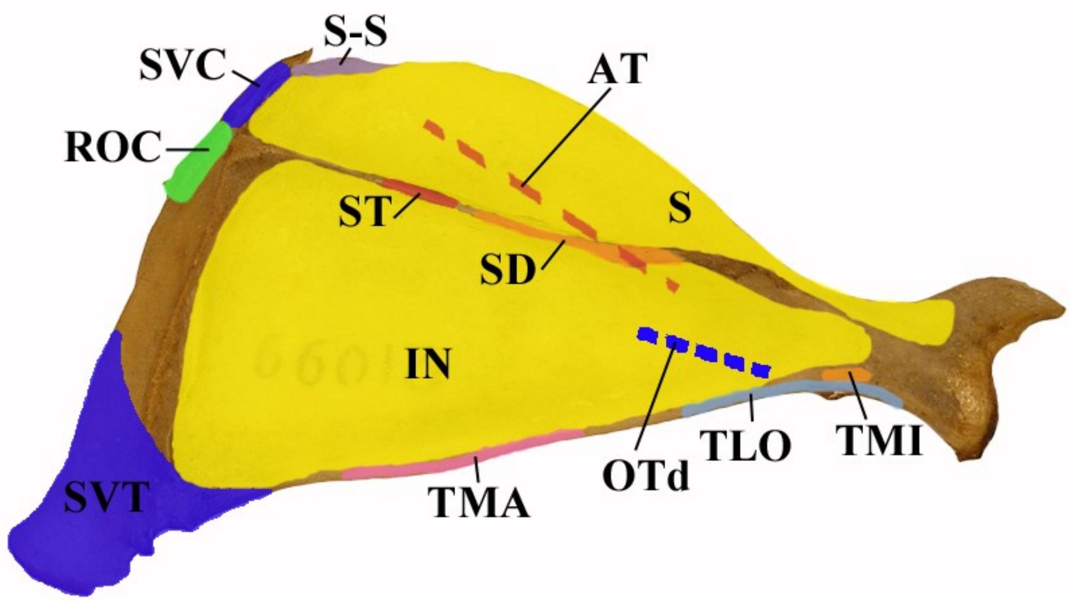
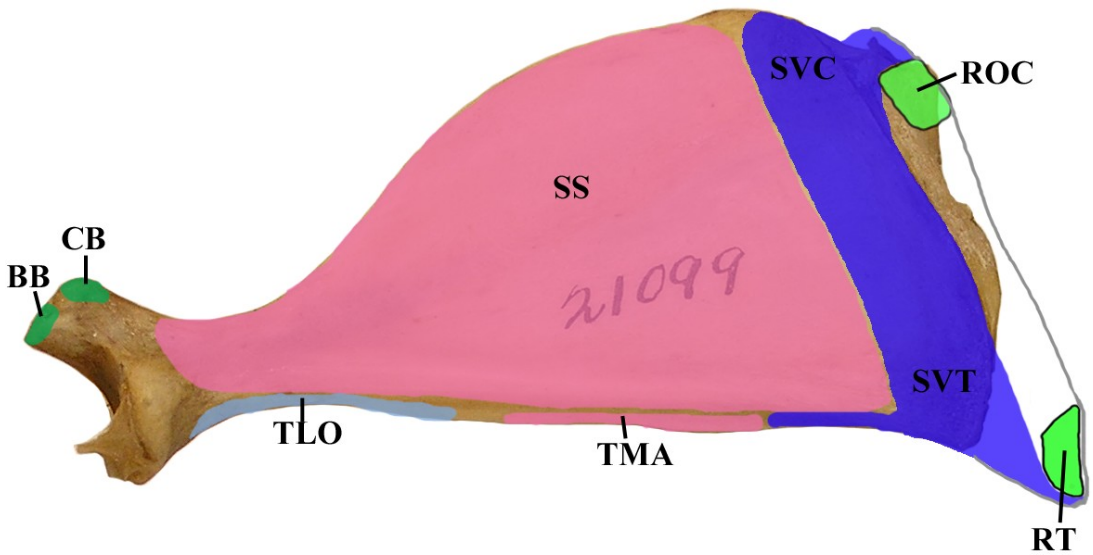


Figure 3.4A-22. Muscles of the manus.
A. Pre-dissection. (P7113590) B. Mm. flexor digitorum breves manus (P6190651). C. Median nerve and flexor tendons (P6190702). D. Mm. contrahentes and flexor digitorum breves profundus (P6190657).

[*- cartilaginous structure, ADM- abductor digiti minimi, C- contrahentes, FBM- flexor digitorum breves manus, FDS- flexor digitorum superficialis, I- flexor digitorum breves profundus, L- lumbricales, m- median nerve, u- ulnar nerve]



A.



B.

Figure 3.4A-23. Muscle attachment maps for the scapula.

A. Superficial surface of the scapula. B. Deep surface of the scapula.

[AD- acromiodeltoideus, AT- acromiotrapezius, BB- biceps brachii, CB- coracobrachialis, D-E- dorso-epitrochlearis, IN- infraspinatus, OTd – dorsal portion of omotransversarius, S- supraspinatus, S-S- sternoscapularis, SS – subscapularis, SVC- serratus ventralis cervicis, SVT- serratus ventralis thoracis, ROC- rhomboideus capitis et cervicis, RT- rhomboideus thoracis, TLO- triceps brachii caput longum, TNA – teres major, TMI – teres minor]

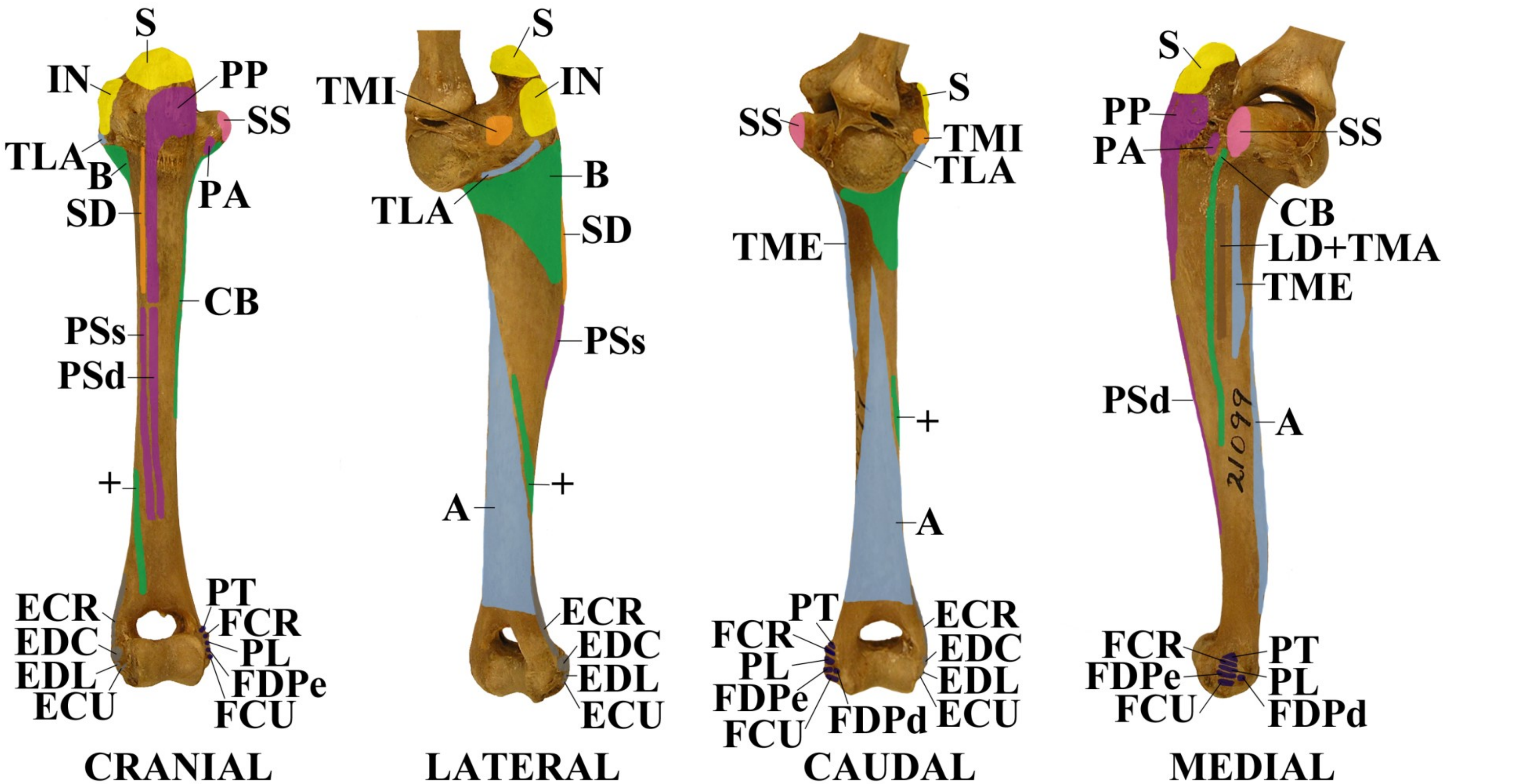


Figure 3.4A-24. Muscle attachment maps for the humerus.

[+ cubitalis, A- anconeus, B- brachialis, CB- coracobrachialis, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, FDPe- superficial portion of flexor digitorum profundus, FDPd- deep portion of flexor digitorum profundus, IN- infraspinatus, LD- latissimus dorsi, PL- palmaris longus, PP- pectoralis profundus, PSd- deep portion pectoralis superficialis, PSs- superficial portion of pectoralis superficialis, PT- pronator teres, S- supraspinatus, SD- spinodeltoideus, SS- subscapularis, TLA- triceps brachii caput laterale, TMA- teres major, TME- triceps brachii caput mediale, TMI- teres minor]

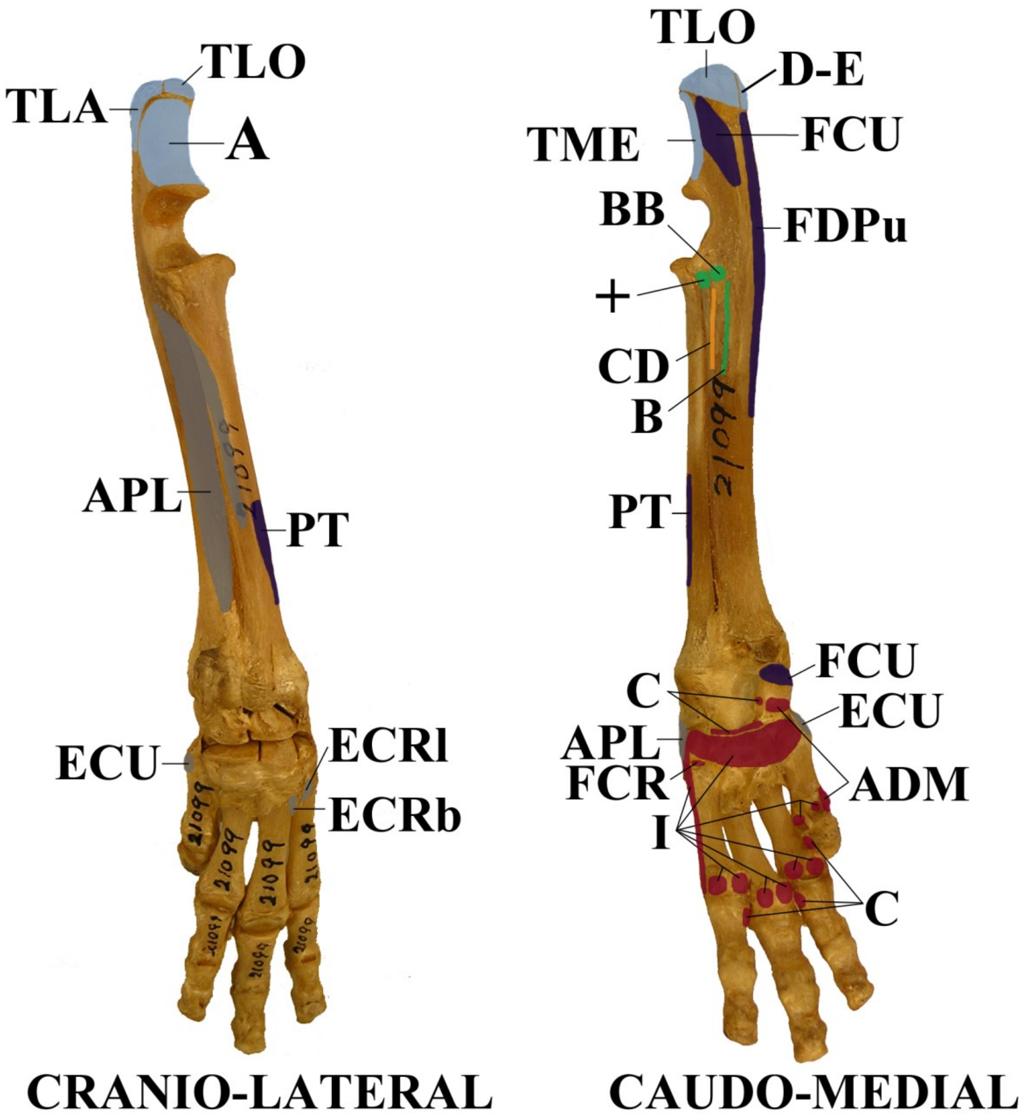


Figure 3.4A-25. Muscle attachment maps for the radius, ulna, and manus.

[+ cubitalis, A – anconeus, ADM – abductor digiti minimi, APL – abductor pollicis longus, B – brachialis, BB – biceps brachii, C – contrahentes, CD – clavodeltoideus, FCR – flexor carpi radialis, FCU – flexor carpi ulnaris, FDPu – ulnar head of flexor digitorum profundus, I – flexor digitorum breves profundus, PT – pronator teres, TLA – triceps brachii caput laterale, TLO – triceps brachii caput longum TME – triceps brachii caput mediale]

3.4B – Hyracoidea – Procaviidae – *Heterohyrax brucei prittwitzi*

The forelimb anatomy of *Heterohyrax* has not been described, although *Procavia* has been described by Murie & Mivart (1865) and Windle & Parsons (1901). The following is a description of the extrinsic and intrinsic muscles of the forelimb of a male specimen of *Heterohyrax brucei*, the yellow-spotted rock hyrax (Hyracoidea, Procaviidae), collected for the National Museum of Natural History in Tanzania. The specimen is in fairly good condition despite an incision through the abdomen and a large number of ectopic parasites.

Figure 3.4B-1. Post-dissection photograph of *Heterohyrax brucei*, NMNH 241587. Lateral view, left side (P7173749).

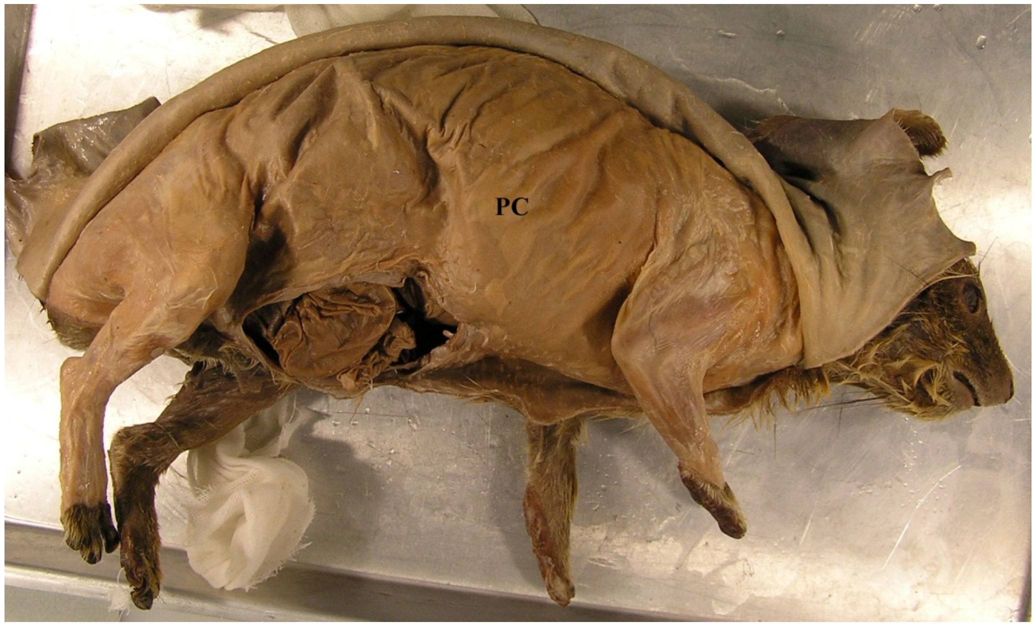
0. CUTANEOUS MUSCULATURE

mm. cutaneous ventralis, sphincter colli, panniculus carnosus, dorsocutaneous

M. cutaneous ventralis, often called the "pectoantebrachium," is a thin, rectangular sheet of muscle that arises from the distal third of the sternum, distal to the origin of m. pectoralis superficialis. It inserts onto the fascia covering the caudal and lateral sides of the antebrachium and the olecranon process.

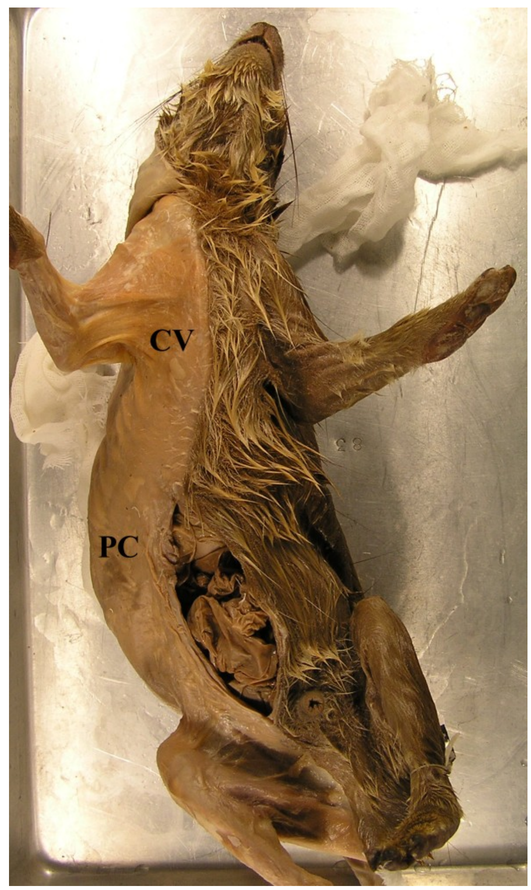
M. sphincter colli encircles the neck. It is robust and comingled with m. clavotrapezius. M. dorso-cutaneous is absent.

M. panniculus carnosus is extensive in *Heterohyrax*, as in *Procavia*, and covers the back and sides of the animal. It originates from the dorsal midline and inserts into the fascia covering the scapula and the caudal surface of m. triceps brachii. Some muscle fibers merge with m. latissimus dorsi in the axilla. In this specimen, there is a large lymph node on the underside of m. panniculus carnosus at the level of the subclavian artery.



A.

B.



C.

Figure 3.4B-2. Cutaneous musculature. A. Lateral view, right side (P2070001). B. Dorsal view. (P2070002) C. Ventral view. (P2070003).

[CV- cutaneous ventralis, PC- panniculus carnosus]

A. TRAPEZIUS GROUP – ACCESSORY NERVE and CERVICAL NERVES

mm. sternomastoideus, cleidomastoideus, clavotrapezius, acromiotrapezius, spinotrapezius

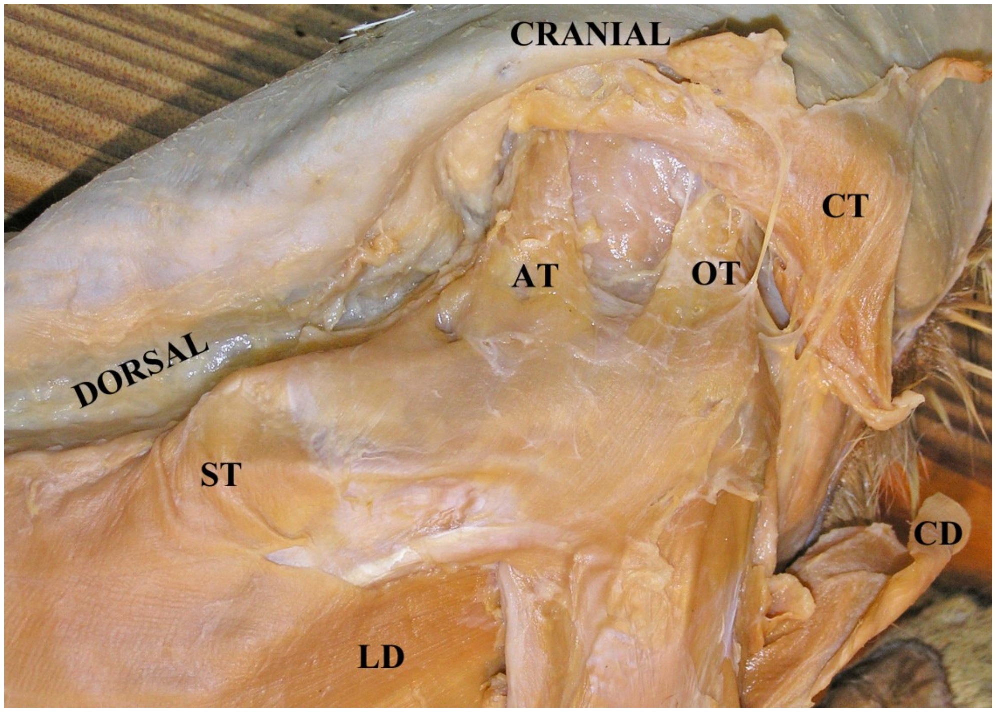
M. sternomastoideus is an extremely robust muscle, 1.5 cm wide and 6 cm long. As in *Procavia*, it originates from the ramus of the mandible and joins with its partner to form a thick ventral raphe in the neck. Distally, its central tendon appears to be ossified in this specimen, forming a bony appendage projecting cranially from the sternum.

M. cleidomastoideus is 2 mm wide and originates by delicate tendinous fibers from the paroccipital. It has a small 1 mm insertion on the manubrium and also inserts on the deep surface of the tendon of insertion of m. sternomastoideus.

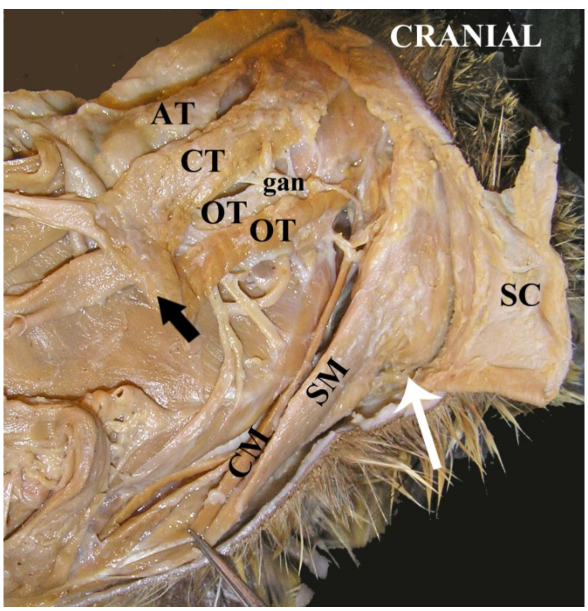
M. clavotrapezius is comingled with m. sphincter colli and cutaneous muscles of the pinna, making it difficult to tell exactly how it courses. It is 1.2 cm wide at its origin along the occipital crest, and extends for 4 cm to its insertion at the clavicular intersection where it is joined by the ventral belly of m. omotransversarius. Together the muscles join with m. clavodeltoideus to form "m. brachiocephalicus."

M. acromiotrapezius is thin and has no real bony attachments, and it does not overlap the origins of clavotrapezius or spinotrapezius. It originates for 5 mm from the ligamentum nuchae and an additional 2.5 cm along the dorsal midline over the proximal thoracic vertebrae. It is 2.5 cm long and inserts onto the fascia covering m. supraspinatus near the insertion of m. spinotrapezius.

M. spinotrapezius is much larger in *Heterohyrax* than in *Procavia*, with a 6.5 cm wide origin from twelve mid-thoracic spinous processes. It is also much more robust than m. acromiotrapezius. It extends 3 cm and inserts onto the posterior third of the scapular spine and the fascia covering m. infraspinatus.



A.



B.

Figure 3.4B-3. Trapezius complex. A. Superficial dorso-lateral view (P2150032). B. Deep view, forelimb removed (P6210941). White arrow indicates angle of mandible; black arrow indicates clavicular intersection.

[AT- acromiotrapezius, CD- clavodeltoideus, CM- cleidomastoideus, CT- clavotrapezius, gan- great auricular nerve, LD- latissimus dorsi, OT- omotransversarius, SC- sphincter colli, SM- sternomastoideus, ST- spinotrapezius]

B. RHOMBOID GROUP – DORSAL SCAPULAR NERVE

mm. rhomboideus capitis, rhomboideus cervicis, rhomboideus thoracis

M. rhomboideus capitis is a robust tube of muscle originating from the occiput and ligamentum nuchae, and inserting on the cartilaginous portion of the scapula near the cranial angle. A few fibers from m. rhomboideus cervicis cross over to join the muscle.

M. rhomboideus cervicis originates as three distinct bands of fibers from the ligamentum nuchae. It inserts, still in distinct bands of fibers, caudal to the insertion of m. rhomboideus capitis on the cartilaginous portion of the vertebral border of the scapula.

M. rhomboideus thoracis is a thin sheet of muscle and the muscle fibers are not well organized. It originates from the spinous processes of six thoracic vertebrae and inserts on the cartilaginous portion near the caudal angle of the scapula.

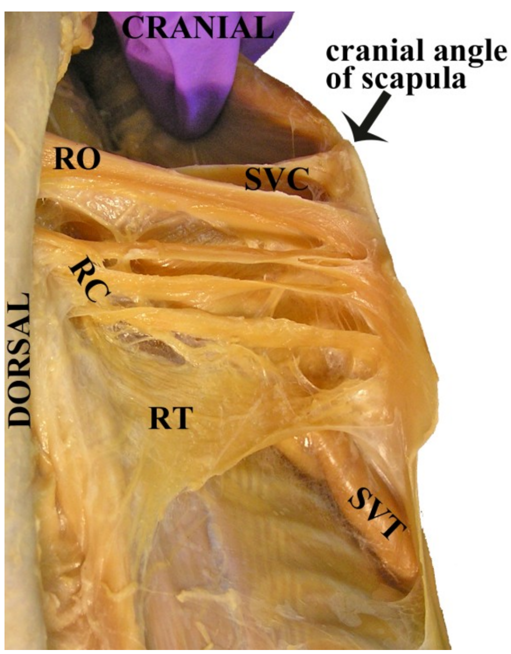


Figure 3.4B-4. Mm. rhomboideus, dorsal view (P2210020).

[RC- rhomboideus cervicis, RO- rhomboideus capitis, RT- rhomboideus thoracis, SVC- serratus ventralis cervicis, SVT- serratus ventralis thoracis]

C. OMO GROUP – CERVICAL NERVES, LONG THORACIC NERVE

mm. omotransversarius, omohyoideus, serratus ventralis (cervicis, thoracis)

There are two bellies of m. omotransversarius, as in *Procavia* and Chrysochloridae. The dorsal belly of m. omotransversarius is narrow where it originates from the transverse process of the third cervical vertebrae and expands to a broad insertion into fascia over mm. infraspinatus and teres minor. Its caudal edge is closely applied to the cranial edge of m. acromiotrapezius, which also inserts into fascia over the scapula. Together the two muscles make a broad, thin sheet of muscle that stretches across the scapula from the cranial angle to the inferior side of the glenoid.

The ventral belly of m. omotransversarius is a 5 mm-wide ribbon of muscle originating from the paroccipital process dorsal to the origin of m. cleidomastoideus, and also by a tiny tendinous slip from the transverse process of the atlas. In ventral view, the muscle is superficial to the dorsal belly of m. omotransversarius and separated from m. sternomastoideus by a large salivary gland. The ventral belly of m. omotransversarius joins the the cranial edge of m. clavotrapezius at the clavicular intersection, where it becomes part of "m. brachiocephalicus."

M. serratus ventralis cervicis originates from the third to the seventh cervical vertebrae and ribs 1-5. It is connected by fascia on its cranial edge with the dorsal belly of m. omotransversarius. M. serratus ventralis thoracis is superficial, slightly overlapping m. serratus ventralis cervicis. It originates by eight digitations from ribs 4-11. The two muscles join into a large fan which inserts onto the entire length of the deep surface of the vertebral border and the caudal angle of the scapula.

M. omohyoideus is absent.

D. DELTOID GROUP – AXILLARY NERVE

mm. clavodeltoideus, acromiodeltoideus, spinodeltoideus, teres minor

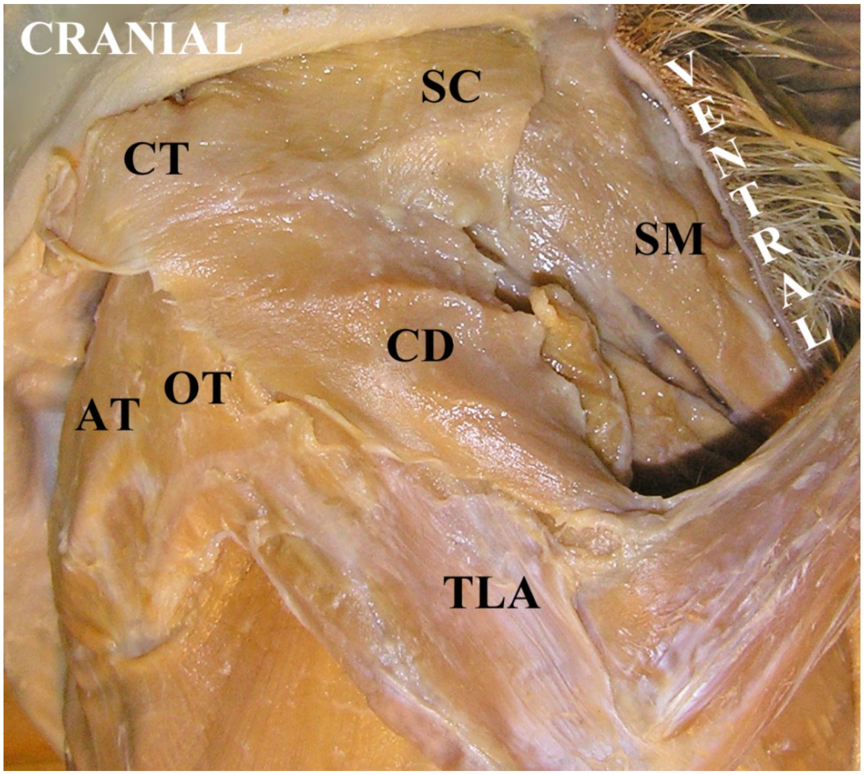
All portions of mm. deltoideus and teres minor are innervated by the axillary nerve, which is visible emerging from underneath m. spinodeltoideus to enter m. clavodeltoideus.

M. clavodeltoideus originates from the clavicular intersection, where it is fused with m. clavotrapezius. Together with the ventral belly of m. omotransversarius, the muscles form the compound "m. brachiocephalicus." On the deep surface of "m. brachiocephalicus" is a shiny tendinous band, clearly demarcating the clavicular intersection and the origin of m. clavodeltoideus. At the clavicular intersection there is also a small fusion with m. sternoscapularis, probably representing m. subclavius. M. clavodeltoideus is quite bulky and is much more closely applied to mm. pectoralis than in *Procavia*. It inserts on the medial ulna between the insertions of mm. biceps brachii and brachialis.

M. acromiodeltoideus is very thin and originates from the fascia over the caudal edge of m. supraspinatus, and also from the fascia over m. infraspinatus.

M. spinodeltoideus is also very thin and originates from the fascia over m. infraspinatus near the caudal border of the scapula. Together mm. acromiodeltoideus and spinodeltoideus cover half of m. infraspinatus. Mm. acromiodeltoideus and spinodeltoideus fuse and have a tendinous insertion on the lateral deltopectoral crest.

M. teres minor is diminutive. It has a fleshy origin from the caudal border of the scapula and inserts via tiny tendinous fibers just deep and distal to the insertion of m. infraspinatus on the caudo-lateral greater tuberosity.

A. 

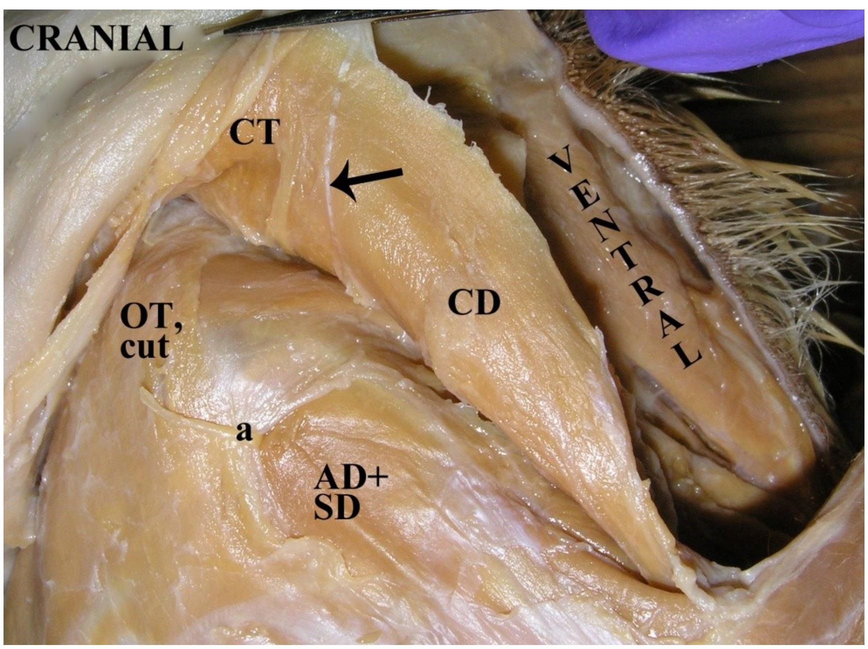
B. 

Figure 3.4B-5. "M. brachiocephalicus."

A. Superficial surface (P2150028). B. Deep surface showing clavicular intersection at black arrow (P2150030)

[a- axillary nerve, AD- acromiodeltoideus, AT- acromiodeltoideus, CD- clavodeltoideus, CT- clavotrapezius, OT- omotransversarius, SC- sphincter colli, SM- sternomastoideus]

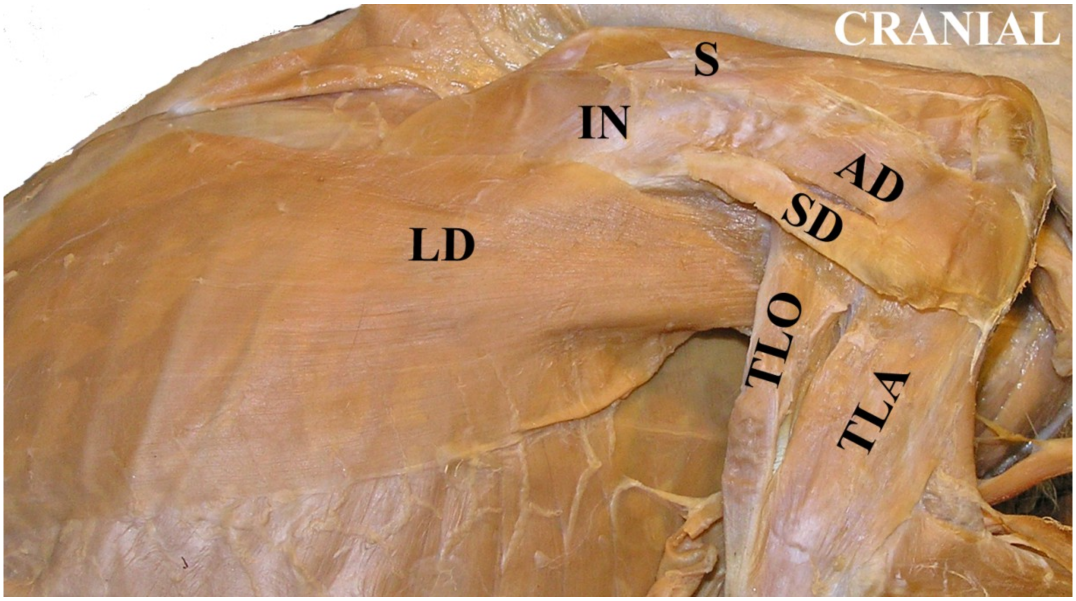


Figure 3.4B-6. Mm. deltoideus, lateral view (P2190004).
[AD- acromiodeltoideus, IN- infraspinatus, LD- latissimus dorsi, S- supraspinatus, SD- spinodeltoideus, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum]

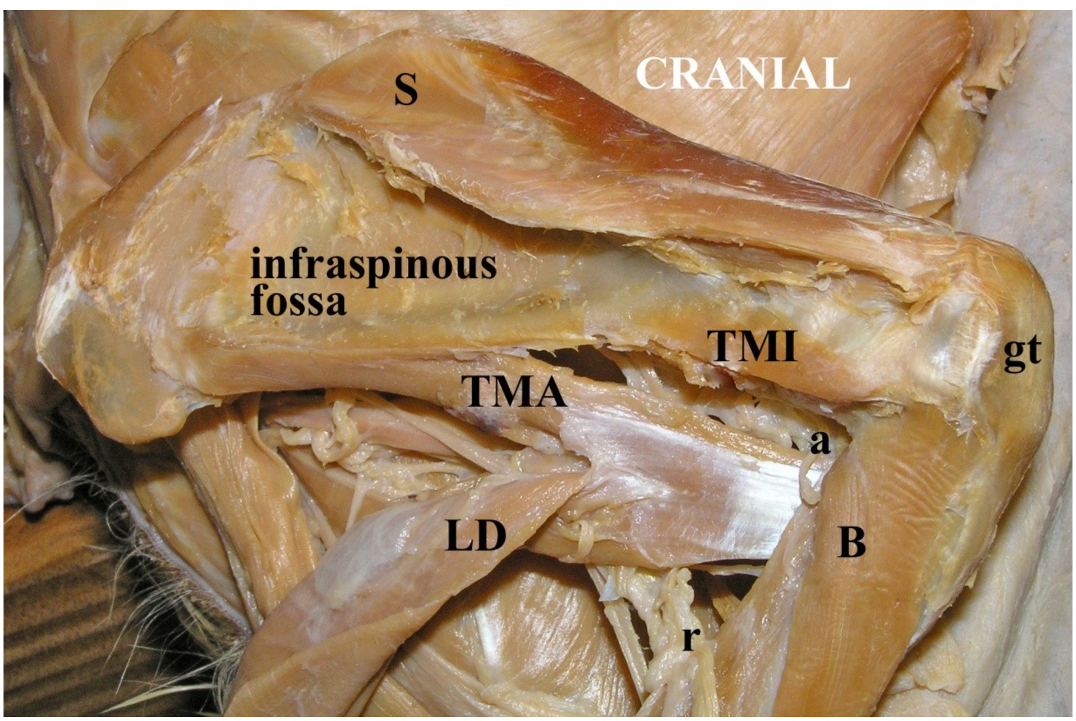


Figure 3.4B-7. M. teres minor, lateral view (P2210026).
[a- axillary nerve, B- brachialis, gt- greater tuberosity, LD- latissimus dorsi, r- radial nerve, S- supraspinatus, TMA- teres major, TMI- teres minor]

E. SUBSCAPULARIS GROUP – SUBSCAPULAR NERVE

mm. subscapularis, teres major

M. subscapularis originates only from the bony portion of the subscapular fossa of the scapula. It is coated in a very thick and shiny tendinous fascia. The muscle is 5.5 cm long, essentially the length of the scapula less the cartilaginous portion, and inserts via a 7 mm wide tendon into the entire caudal surface of the lesser tuberosity.

M. teres major has an origin from the caudal border of the scapula, from the caudal angle to about halfway along the bone. It travels deep to mm. triceps brachii and fuses with m. latissimus dorsi. Together they insert on the cranio-medial surface of the humerus, deep to m. coracobrachialis.

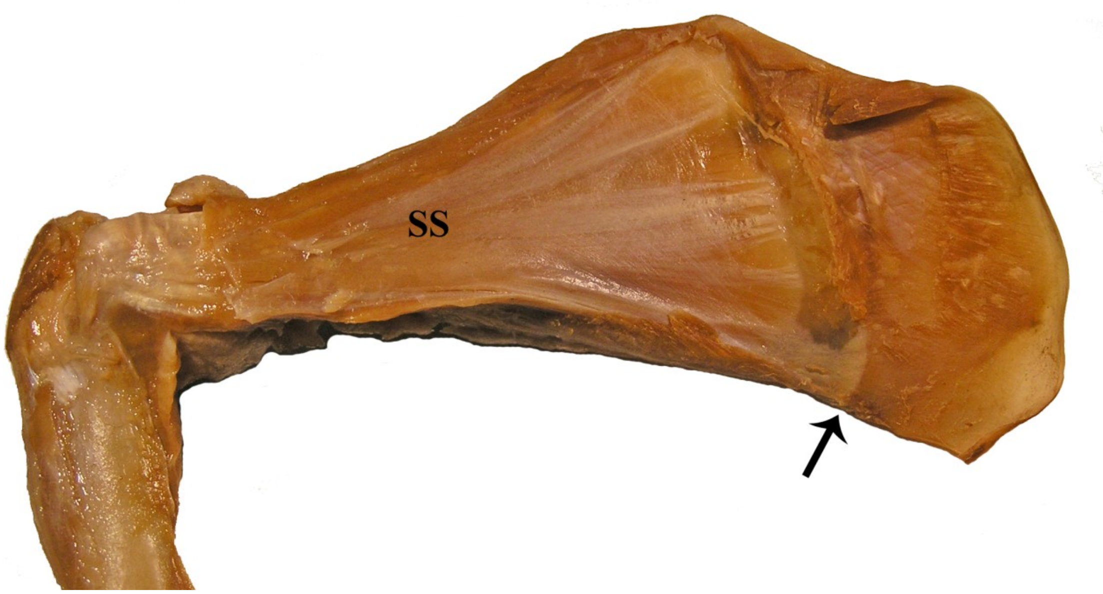


Figure 3.4B-8. M. subscapularis, deep surface of scapula (P7123607).

Arrow marks boundary between bony and cartilaginous portions of scapula.
[SS- subscapularis]

F. LATISSIMUS GROUP – THORACODORSAL NERVE

m. latissimus dorsi

M. latissimus dorsi originates just caudal to the origin of m. spinotrapezius, from the thoracolumbar fascia along thoracic vertebrae 12-20 and the first lumbar vertebra. It has no rib attachments. A small slip from the medial edge of m. latissimus dorsi goes medial to the brachial plexus and ends in the fascia covering m. biceps brachii. The rest of the broad, fan-shaped muscle fuses with m. teres major before inserting on the cranio-medial surface of the humerus. There is a large lymph node on the underside of m. latissimus dorsi at the point of fusion with m. teres major.

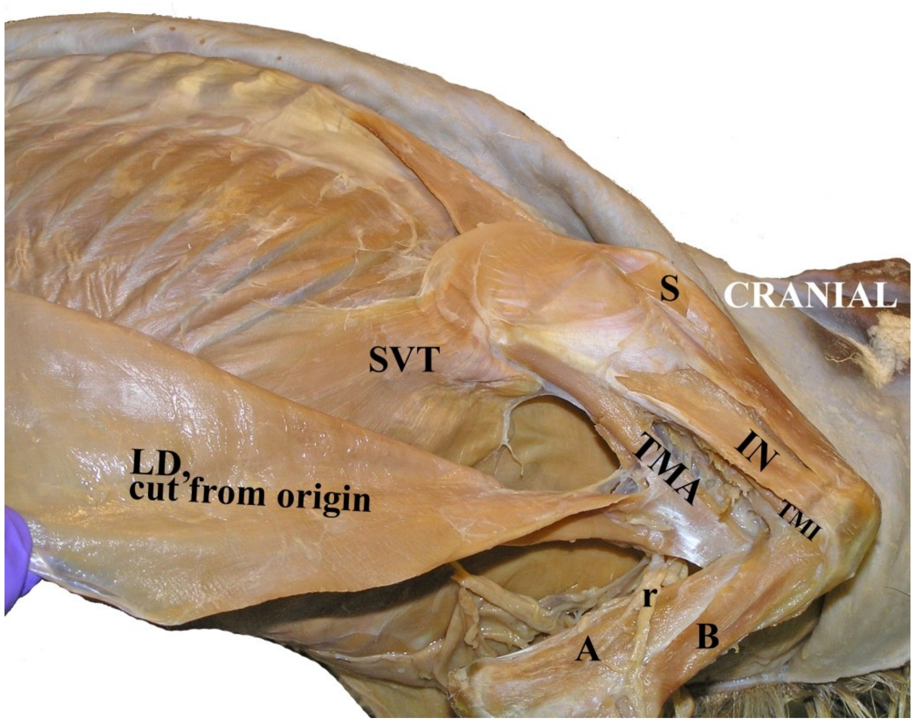


Figure 3.4B-9. Mm. latissimus dorsi and teres major, lateral view (P2200014).

[A- anconeus, B- brachialis, IN- infraspinatus, LD- latissimus dorsi, r- radial nerve, S- supraspinatus, SVT- serratus ventralis thoracis, TMA- teres major, TMI- teres minor]

G. PECTORALS GROUP – PECTORAL NERVES

mm. pectoralis superficialis, pectoralis profundus, pectoralis abdominalis, subclavius, sternoscapularis

As in *Procavia,* there are superficial and deep layers to m. pectoralis superficialis, both originating from the sternum superficial to m. sternomastoideus. The superficial layer of m. pectoralis superficialis is 3 cm wide and covers most of the insertion of m. sternomastoideus. The muscle fibers run directly across to the humerus, where they insert along much of the delto-pectoral crest. The deep layer of m. pectoralis superficialis originates more distally on the sternum and is only 2 cm wide and thinner than the superficial layer of m. pectoralis superficialis. It originates from slightly lower on the sternum, so its fibers angle slightly cranially rather than straight across. It inserts on the delto-pectoral crest medial to the insertion of the superficial layer.

With the necropsy work done on the specimen, it is quite clear where m. pectoralis profundus originates near the caudal end of the xiphisternum, 1 cm from the caudal-most edge of the cartilage. It exchanges fibers with m. pectoralis abdominalis, which lies laterally, and also with m. sternoscapularis, which lies medially, before inserting along the proximal delto-pectoral crest, medial to the insertion of mm. deltoideus.

M. pectoralis abdominalis originates from m. external oblique caudo-lateral to and somewhat fused with both mm. pectoralis profundus and panniculus carnosus. It sends one slip to join m. latissimus dorsi, one to join m. dorso-epitrochlearis, and another 7 mm wide slip courses parallel to m. pectoralis profundus and inserts into the distal edge of the lesser tuberosity of the humerus, just cranial and medial to the insertion of m. pectoralis profundus. Originally I believed this muscle to be part of m. panniculus carnosus.

M. subclavius originates from the top of the manubrium and m. sternoscapularis from the sternum. The muscles are separated with difficulty and appear to be almost fused, with additional fusion between the caudal edge of mm. sternoscapularis and pectoralis profundus. The fused mm. subclavius et sternoscapularis has a connection with the clavicular intersection, presumably demarcating the insertion of m. subclavius, and the remainder of the muscle sweeps over the shoulder and inserts into the fascia over m. supraspinatus. It is 15 cm long.

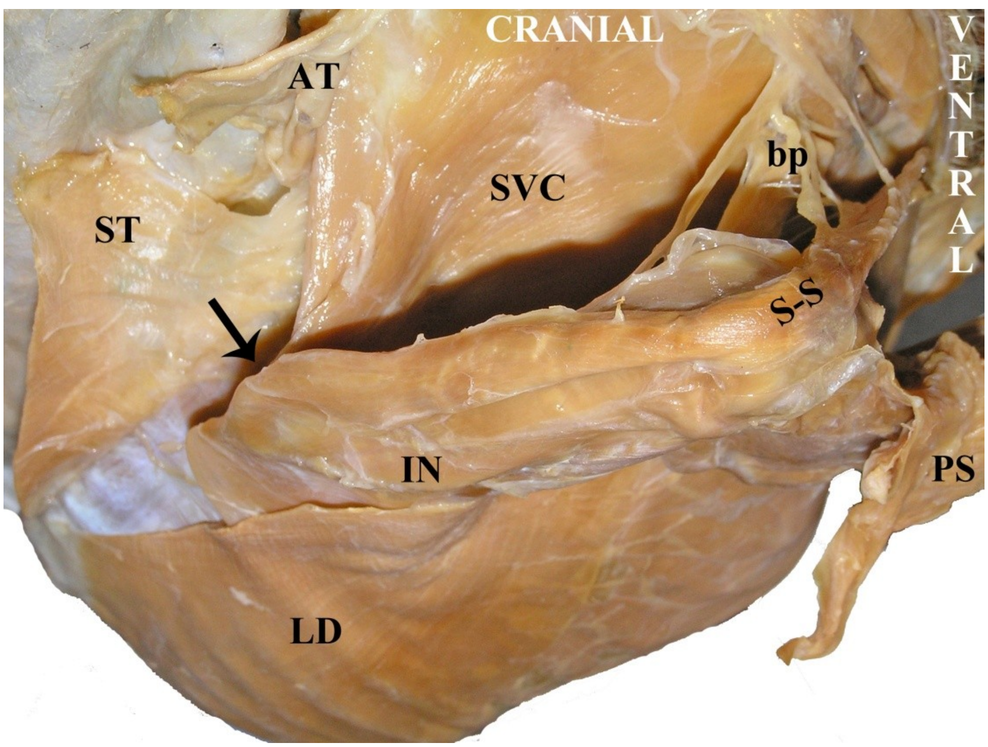


Figure 3.4B-10. M. sternoscapularis inserting on the scapula, cranial view (P2150038). Black arrow marks cranial angle of scapula.

[AT- acromiotrapezius, bp – brachial plexus, IN- infraspinatus, LD- latissimus dorsi, PS- pectoralis superficialis, S-S- sternoscapularis, ST- spinotrapezius, SVC- serratus ventralis cervicis]

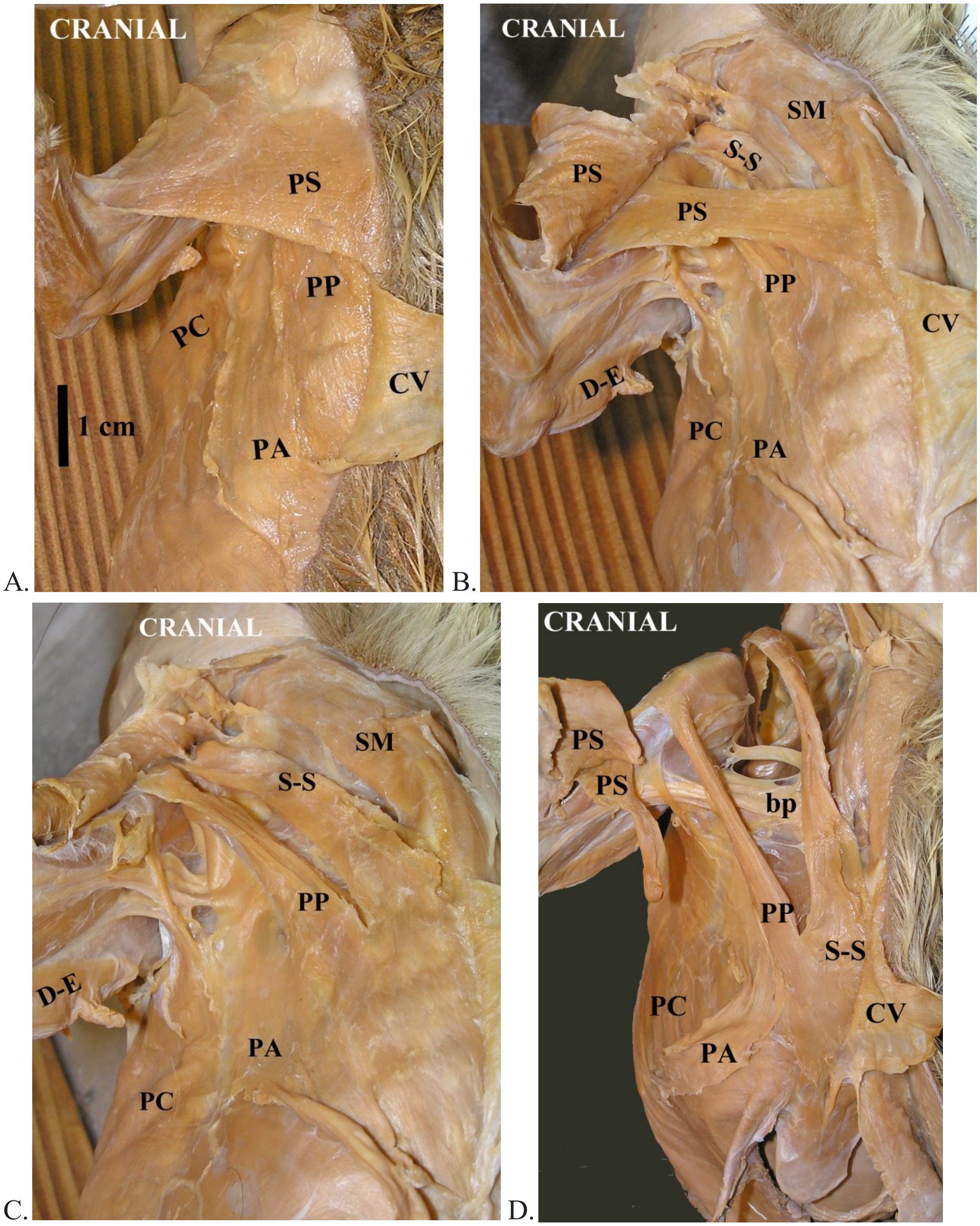


Figure 3.4B-11. Mm. pectoralis, ventral view. A. Superficial portion of m. pectoralis superficialis (P2120017). B. Deep portion of m. pectoralis superficialis (P2120025). C. Mm. pectoralis profundus and sternoscapularis, in situ (P2120027). D. Mm. pectoralis profundus and sternoscapularis, dissected out (P2150041).

[bp- brachial plexus, CV- cutaneous ventralis, D-E- dorso-epitrochlearis, PA- pectoralis abdominalis, PC- panniculus carnosus, PP- pectoralis profundus, PS- pectoralis superficialis, S-S- sternoscapularis, SM- sternomastoideus]

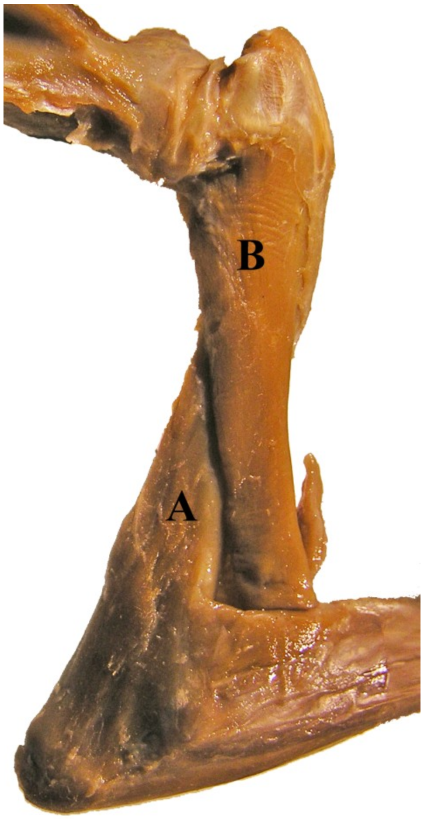
H. BICEPS GROUP – MUSCULOCUTANEOUS NERVE
mm. coracobrachialis, biceps brachii, brachialis, cubitalis

M. coracobrachialis is a triangular muscle, more robust than in *Procavia*. It originates from the cranial surface of the coracoid by a 5 mm long tendon. It covers the insertion of mm. teres major and latissimus dorsi, and then has a 2.5 cm tendinous insertion on the cranio-medial humerus. It is pierced by the musculocutaneous nerve.

M. biceps brachii originates as a tendon from the glenoid of the scapula. The 1 cm long tendon passes deep to the transverse humeral ligament stretching between the greater and lesser tuberosities, and becomes a fusiform belly lying on the cranial surface of the humerus. M. biceps brachii is also pierced by the musculocutaneous nerve. It inserts on a small rugosity on the medial ulna, just distal to the joint capsule.

M. brachialis has an extensive origin along the caudal surface of the proximal humerus. Medially, it begins just distal to the lesser tuberosity and even from the caudal edges of the tendon of insertion of m. subscapularis. Laterally it reaches the base of the fossa marking the insertion of m. infraspinatus, and just distal to the greater tuberosity almost reaching the delto-pectoral crest. The muscle sweeps laterally around the arm and is 9 mm at its widest. It inserts via tendinous fibers on the medial ulna, cranial and distal to the insertion of m. biceps and the small additional muscle in the cranial arm.

There is a small additional muscle, here named m. cubitalis, which is a long thin strip of muscle in close connection with and innervated by the radial nerve. It originates from the cranial surface of the humerus just past midshaft, and inserts on the medial ulna between the insertions of mm. brachialis and biceps brachii.



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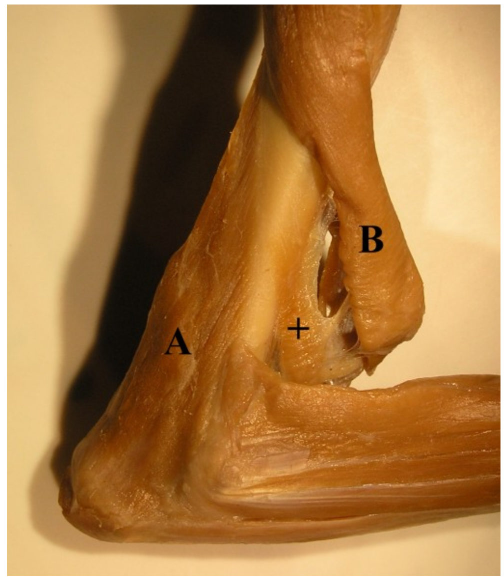

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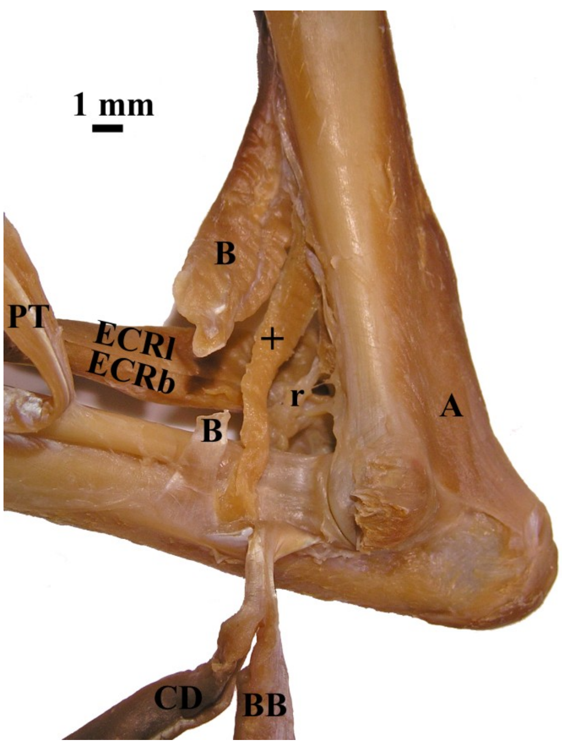


C.

+ cubitalis,
A- anconeus,
B- brachialis,
BB- biceps brachii,
CD- clavodeltoideus,
ECRb- extensor carpi radialis brevis,
ECRl- extensor carpi radialis longus,
PT- pronator teres,
r- radial nerve

Figure 3.4B-12. Muscles of the biceps group.

A. M. brachialis, lateral view (P7123614). B. M. brachialis reflected showing m. cubitalis [+], lateral view (P7163677). C. Biceps group insertions, medial view (P7203946).

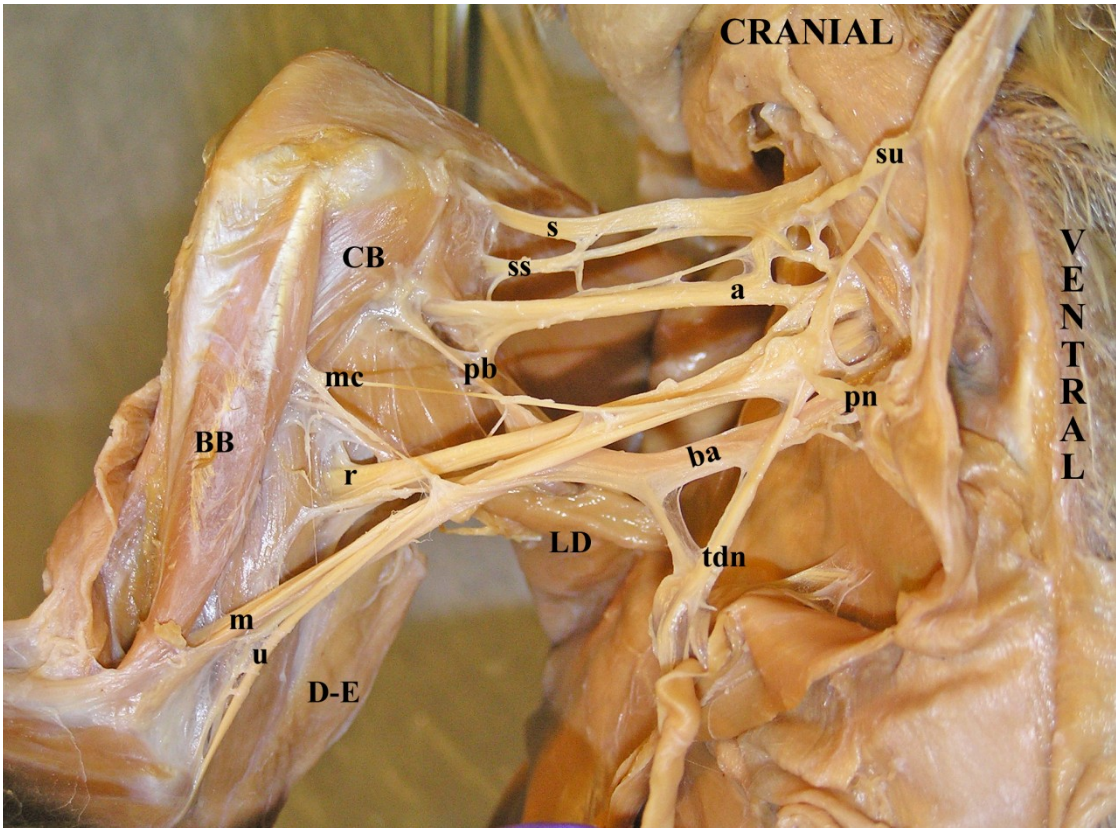


Figure 3.4B-13. Brachial plexus and biceps group, cranial view (P2180048).

[a- axillary nerve, ba- brachial artery, BB- biceps brachii, CB- coracobrachialis, D-E- dorso-epitrochlearis, LD- latissimus dorsi, m- median nerve, mc- musculocutaneous nerve, pb- profunda brachii artery, pn- pectoral nerves, r- radial nerve, s- suprascapular nerve, ss- subscapular nerve, su- nerve to the subclavius, tdn- thoracodorsal nerve, u- ulnar nerve]

I. SPINATI GROUP – SUPRASCAPULAR NERVE

mm. supraspinatus, infraspinatus

M. supraspinatus muscle originates from the supraspinous fossa of the scapula and also overhangs the vertebral border of the scapula. There is a strong and broad U-shaped tendon inserting into the greater tuberosity of the humerus. The suprascapular nerve is visible entering the muscle.

M. infraspinatus is fan-shaped and originates from the bony portion of the infraspinous fossa and the cartilaginous part of the scapula. It inserts via a tendon into the distinct fossa on the lateral side of the greater tuberosity.

J. TRICEPS GROUP – RADIAL NERVE

mm. dorso-epitrochlearis, triceps brachii (caput laterale, caput mediale, caput longum), anconeus

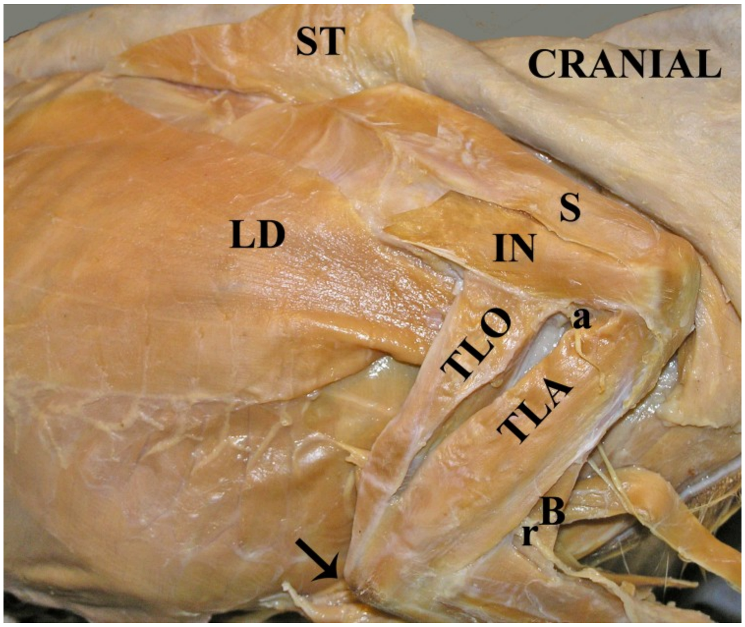
M. dorso-epitrochlearis is very indistinct, but is found on the medial side of the arm, inserting on the medial olecranon.

M. triceps brachii caput laterale has a tendinous origin along the lateral delto-pectoral crest and fleshy origin along the neck of the humerus and the gleno-humeral joint capsule. It inserts on the lateral olecranon.

M. triceps brachii caput mediale originates on the caudo-medial humerus just distal to the lesser tuberosity. It inserts on the medial side of the cranial surface of the olecranon.

M. triceps brachii caput longum is split by a branch of the radial nerve into two heads, superficial and deep, which are not as divided as they are in *Procavia*. They originate on the glenoid half of the caudal border of the scapula, and insert on the tip of the olecranon.

M. anconeus is a 4 cm long triangular muscle originating from the entire caudal surface of the distal half of the humerus. It inserts on the cranial surface of the olecranon.



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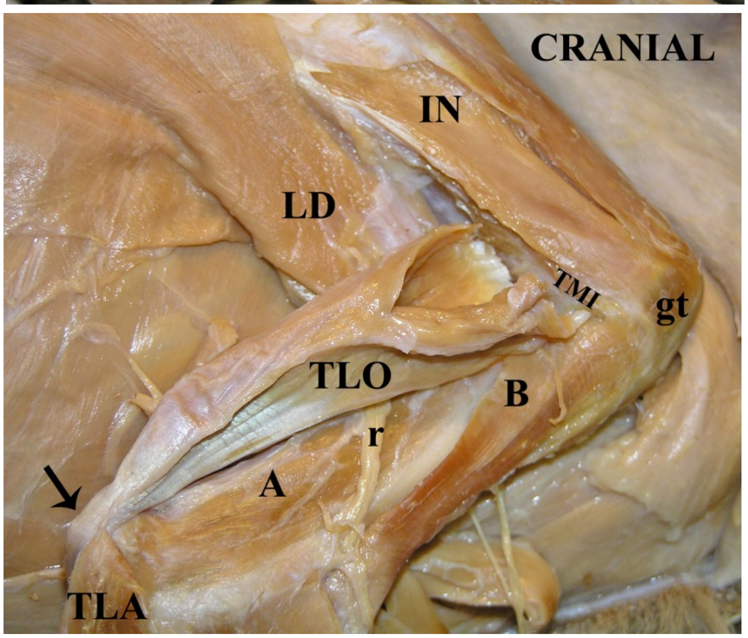


B.

Figure 3.4B-14. Mm. triceps brachii, lateral view. A. Superficial (P2200006). B. M. triceps brachii caput laterale reflected (P2200010). Arrow marks olecranon process.

[a- axillary nerve, A- anconeus, B- brachialis, gt- greater tuberosity, IN- infraspinatus, LD- latissimus dorsi, S- supraspinatus, ST- spinotrapezius, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, TMI- teres minor]

K. EXTENSOR GROUP – RADIAL NERVE

mm. brachioradialis, extensors carpi radialis longus et brevis, extensor digitorum communis, extensor digitorum lateralis, extensor carpi ulnaris, supinator, abductor pollicis longus, extensor digitorum profundus

All the extensors were covered with thick white fascia and pass through a robust retinaculum at the wrist. M. brachioradialis is absent.

M. extensor carpi radialis longus originates for 4 mm along the lateral supracondylar crest, originating deep and only slightly proximal to the origin of m. extensor digitorum communis. M. extensor carpi radialis brevis originates deep and medial to m. extensor carpi radialis longus, but in connection with the deep surface of m. extensor digitorum communis. The two muscles are fully separable for their lengths. They cross deep to the tendon of m. abductor pollicis longus and insert on the dorsal surface of metacarpal II (longus) and metacarpal III (brevis).

The radial nerve supplies mm. triceps brachii and anconeus in the arm, and travels into the cubital fossa deep to m. brachialis. It supplies the additional muscle in the cranial compartment of the arm, then travels deep to m. extensor carpi radialis. It gives branches to mm. extensor digitorum communis, extensor digitorum lateralis, extensor carpi ulnaris, and to the proximal end of m. abductor pollicis longus. Then it travels along the surface of m. abductor pollicis longus in the tough tissue which separates m. extensor digitorum communis from m. extensor digitorum lateralis. The superficial branch of the radial nerve supplies sensory innervation to the dorsum of the manus over digits II and III.

M. extensor digitorum communis has a 12 mm wide origin from the lateral supracondylar crest, the proximal lateral epicondyle, and the joint capsule. The fleshy and robust muscle has a fascial connection with m. brachialis. The muscle appears to be somewhat divided into two portions, a larger portion which sends a tendon to the lateral side of digit II, a tendon down the center of digit III which divides to serve both medial and lateral sides, and a tendon to the medial side of digit IV. The other much smaller portion, nearly separable and with a more tendinous origin than the larger portion, sends a tendon to the medial side of digit V.

M. extensor digitorum lateralis has a 2 mm wide origin from the lateral epicondyle. Its single belly splits into two robust tendons which insert on the lateral side of digits IV and V. The tendon for digit IV crosses deep to the tendon of m. extensor digitorum communis to digit V.

M. extensor carpi ulnaris has a 4 mm wide origin from the distal lateral epicondyle. It is fleshy for 4 cm and then becomes a wide, flat tendon which inserts on the base of metacarpal V.

M. abductor pollicis longus originates for 3.5 cm along the lateral ulna and radius, beginning just distal to the humeral-ulnar articulation and filling the interosseus space. At the carpus, it crosses over the tendons of m. extensor carpi radialis and inserts on the medial surface of the tiny metacarpal I, covering the entire bone. It is also in close connection with the extensor retinaculum and the fibrocartilaginous palmar aponeurosis around the medial carpus.

M. extensor digitorum profundus and m. supinator are absent.

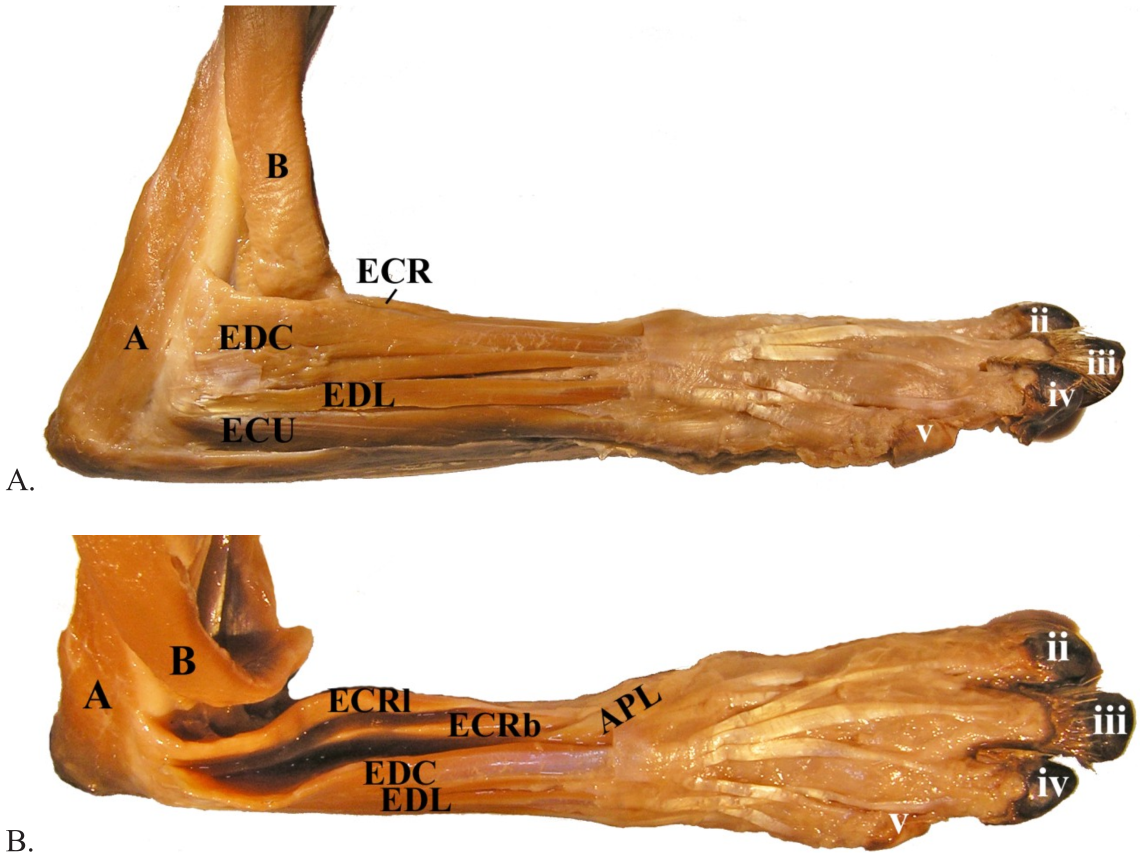


Figure 3.4B-15. Muscles originating from the lateral epicondyle. A. Lateral view (P7163652). B. Cranial view (P7163690).

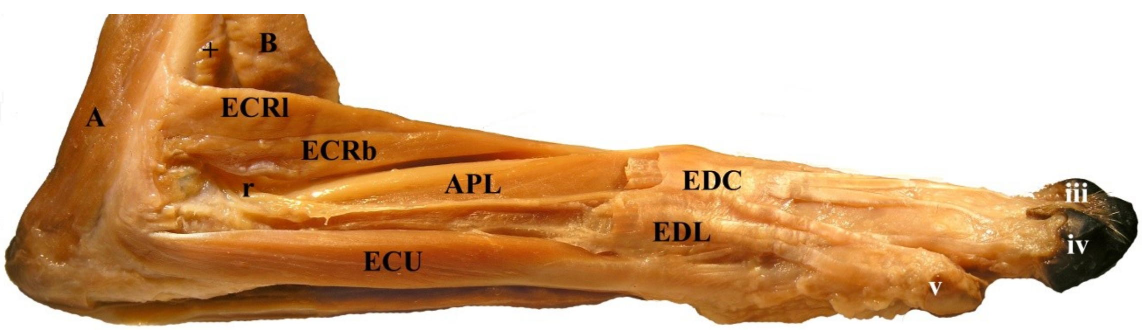


Figure 3.4B-16. M. abductor pollicis longus, lateral view (P6220340).

[+ additional muscle, A- anconeus, APL- abductor pollicis longus, B- brachialis, ECR- extensor carpi radialis, ECRb- extensor carpi radialis brevis, ECRl- extensor carpi radialis longus, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis]

L. FLEXOR GROUP – MEDIAN & ULNAR NERVES

mm. pronator teres^{m}, flexor carpi radialis^{m}, palmaris longus^{u}, flexor digitorum superficialis^{m}, flexor digitorum profundus^{m+u}, flexor carpi ulnaris^{u}, epitrochleo-anconeus^{u}, pronator quadratus^{m}

M. pronator teres originates from the medial epicondyle. It is a small muscle and fleshy for only 1.5 cm. It then becomes a broad tendon which inserts on the cranial aspect of the radius for 1.5 cm, extending almost to the carpus.

M. flexor carpi radialis originates from the medial epicondyle. The muscle belly is fleshy for 2.5 cm and then becomes a long, slender tendon. It crosses over the median nerve, dives deep to the fibrocartilaginous palmar aponeurosis on the medial carpus, and travels through a groove on the palmar carpus to insert on the trapezium.

M. flexor digitorum superficialis originates from the surface of the superficial epicondylar head of m. flexor digitorum profundus. Near where the median nerve crosses over the muscle, just proximal to the pisiform, a pair of small fusiform bellies appears. Each divides again, forming four truly tiny muscles which become tendon a few millimeters later. The medial tendon goes to form the perforated tendon of digit II. The two middle tendons join and form the perforated tendon for digit III. The lateral tendon goes to form the perforated tendon of digit IV. "M. interflexorii" may be represented by a small bundle of fibers which leave the medial edge of m. flexor digitorum superficialis and insert on the medial edge of the conjoined tendon of m. flexor digitorum profundus just before the carpus.

M. palmaris longus is enormously developed. It originates from the medial epicondyle and from the surface of m. flexor digitorum superficialis and the humeral head of m. flexor carpi ulnaris. It ends in the fibrocartilaginous palmar aponeurosis covering the medial carpus. This unusually well-developed palmar aponeurosis has tendinous bands which form almost a heart shape across the palm. There is a large central band over metacarpal III and curved bands along the lateral sides over metacarpals II and V. From the central band there are slips to digits II-IV. These slips insert onto the palmar surface of the metacarpophalangeal joints. On the deep surface of the palmar aponeurosis is a cartilaginous concavity which cups the large pisiform.

The median nerve travels through the cubital fossa and deep to mm. pronator teres and flexor carpi radialis. Just proximal to the carpus, it curves around to run on the superficial surface of m. flexor digitorum superficialis. It sends a miniscule branch across the fibrocartilaginous palmar aponeurosis to the lateral side of the vestigial pollex. The rest of the nerve travels deep to the fibrocartilaginous palmar aponeurosis, medial to the ulnar nerve and its fibrous retinaculum. Travelling deep to m. flexor digitorum brevis manus for digit II, which it innervates, it sends digital branches along both sides of digits II and III and the medial side of digit IV. At the base of digit IV a portion of the median nerve seems to join the deep branch of the ulnar nerve in the carpus.

M. flexor digitorum profundus is not typical for eutherian mammals, due to its connection with m. flexor digitorum superficialis, but it is not unusual for Afrotheria. There are three heads of origin. The superficial epicondylar belly of m. flexor digitorum profundus originates from the distal medial epicondyle. It is fused with the deep surface of m. flexor digitorum superficialis, but it receives a distinct branch of the ulnar nerve.

At the carpus, it joins the medial edge of the ulnar portion of m. flexor digitorum profundus, thus ending up on the middle of the superficial surface of the conjoined flexor tendon. The deep epicondylar belly of m. flexor digitorum profundus originates from the caudal surface of the medial epicondyle, and its tendon slides in the groove beneath the medial epicondyle. It joins the medial half of the conjoined flexor tendon. The muscle receives a branch of the median nerve. The ulnar portion of m. flexor digitorum profundus originates from the caudal surface of the ulna, covering nearly the entire caudal border deep to m. flexor carpi ulnaris. It joins the conjoined tendon of m. flexor digitorum profundus at the carpus. The large conjoined tendon is closely applied to the deep surface of the tendons of flexor digitorum superficialis. In the palm, it splits into four pieces inserting on digits II-V, with the portion for digit V being the smallest. There are two cartilaginous plates formed in the ligaments over the carpals and metacarpals, presumably to allow smooth passage of the tendons of m. flexor digitorum profundus.

M. flexor carpi ulnaris has two heads of origin. The humeral belly is quite small, only 1 mm wide, and gives partial origin to m. palmaris longus. After 2 cm, it fuses with the ulnar belly, which originates from the distal medial olecranon. They insert together via a strong tendon into the pisiform, deep to the fibrocartilaginous palmar aponeurosis.

M. epitrochleo-anconeus is absent in *Heterohyrax*, so the ulnar nerve simply passes behind the medial epicondyle and dives deep between the heads of m. flexor carpi ulnaris. It sends a branch to the proximal end of the ulnar belly of m. flexor carpi ulnaris, a tiny branch to the small humeral belly of flexor carpi ulnaris, and a branch to the deep surface of the superficial epicondylar belly of m. flexor digitorum profundus. Through the forearm it runs deep to m. flexor carpi ulnaris, splitting into two parts. At the carpus, one half, the superficial branch of the ulnar nerve, exits under the lateral edge of m. flexor carpi ulnaris to supply the dorsal surface of the medial side of digit IV and the small digit V. However, the other half, the deep branch of the ulnar nerve, travels deep to the fibrocartilaginous palmar aponeurosis, which sends a fibrous band to the medial edge of the pisiform, forming a fibrous tunnel through which the nerve travels into the palm. It enters the deep surface of m. flexor digitorum brevis manus for digit V, and also innervates m. abductor digiti minimi and mm. flexor digitorum breves profundus. Deep to mm. flexor digitorum breves manus it sends a small digital branch to the lateral side of digit V and larger branches to the medial side of digit V and lateral side of digit IV.

M. pronator quadratus is represented only by a few shimmery fibers running across the distal third of the radius and ulna.

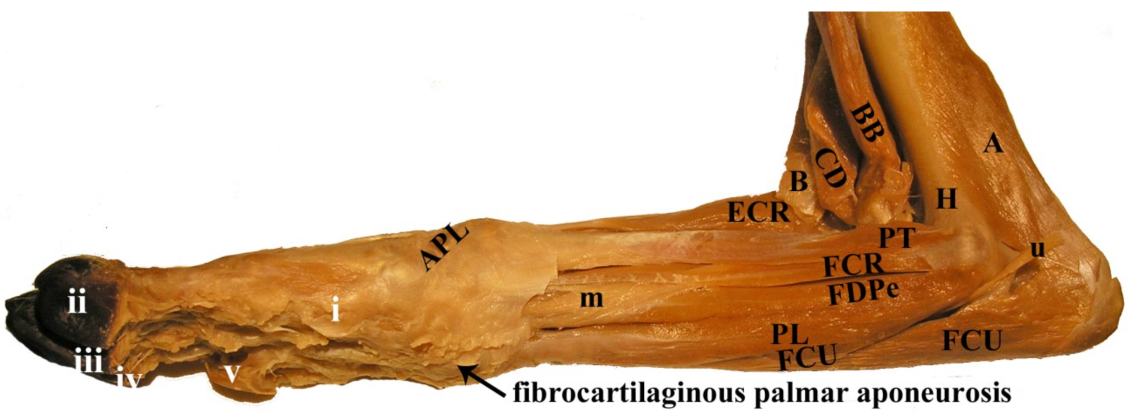


Figure 3.4B-17. Muscles originating from the medial epicondyle, medial view (P7163663).

[A- anconeus, APL- abductor pollicis longus, B- brachialis, BB- biceps brachii, CD- clavodeltoideus, ECR- extensor carpi radialis, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, FDPe- superficial epicondylar belly of flexor digitorum profundus, H- humerus, m- median nerve, PL- palmaris longus, u- ulnar nerve]

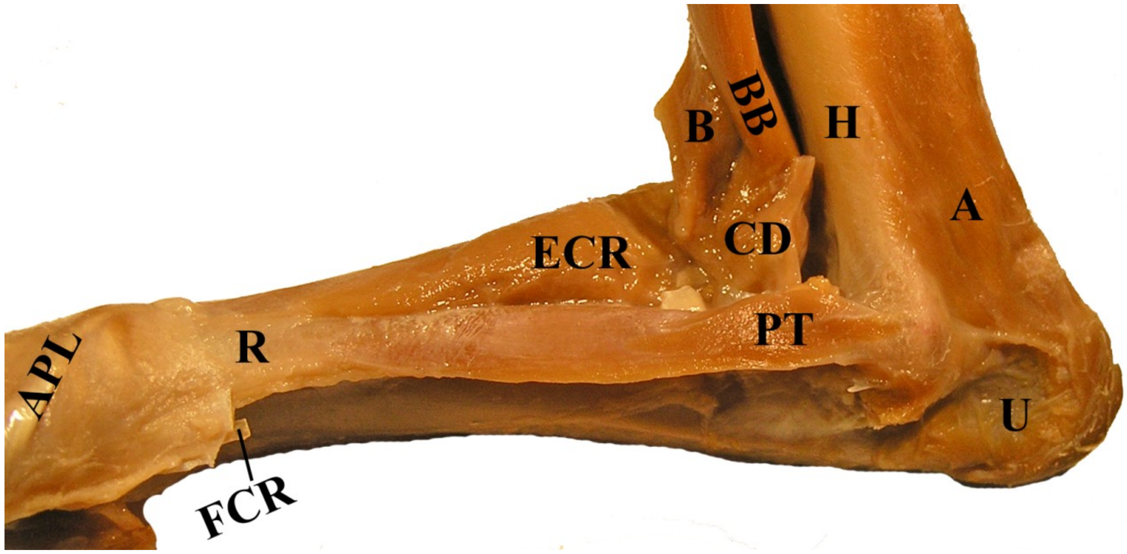


Figure 3.4B-18. M. pronator teres, medial view (P7183894).

[APL- abductor pollicis longus, A- anconeus, B- brachialis, BB- biceps brachii, CD- clavodeltoideus, ECR- extensor carpi radialis, FCR- flexor carpi radialis, H- humerus, PT- pronator teres, R- radius, U- ulna]

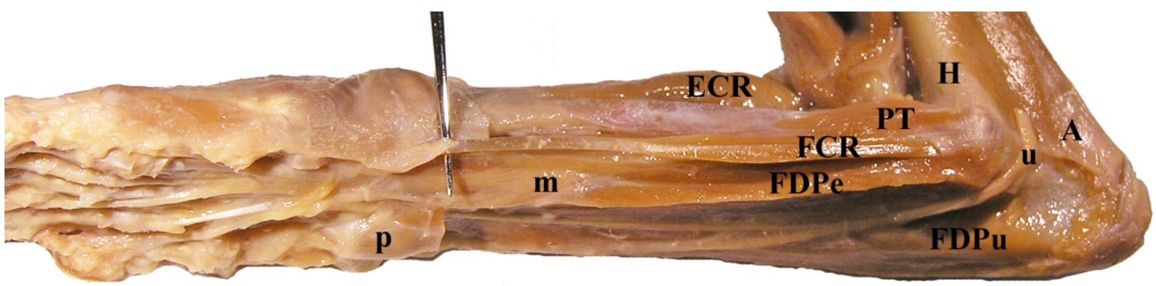


Figure 3.4B-19. M. flexor carpi radialis, medial view (P7183809).

[A- anconeus, ECR- extensor carpi radialis, FCR- flexor carpi radialis, FDPe- superficial epicondylar head of flexor digitorum profundus, FDPu- ulnar head of flexor digitorum profundus, H- humerus, m- median nerve, p- pisiform, u- ulnar nerve]

Figure 3.4B-20. M. flexor digitorum superficialis, caudal view (P7183843).

[ADM- abductor digiti minimi, FDPe- superficial epicondylar head of flexor digitorum profundus, FDPu- ulnar head of flexor digitorum profundus, FDS- flexor digitorum superficialis]

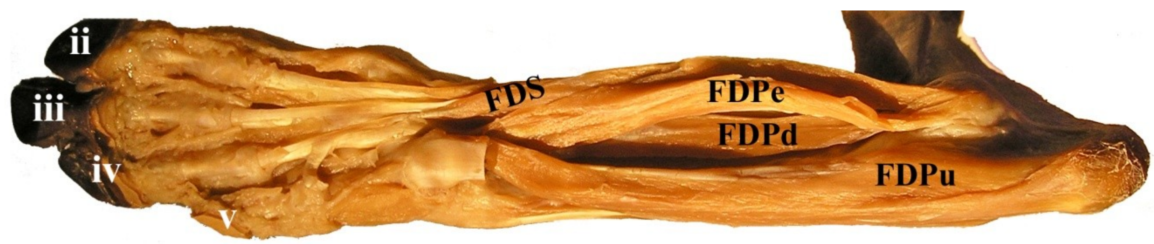


Figure 3.4B-21. M. flexor digitorum profundus, caudal view (P7183862).

[FDPd- deep epicondylar head of flexor digitorum profundus, FDPe- superficial epicondylar head of flexor digitorum profundus, FDPu- ulnar head of flexor digitorum profundus, FDS- flexor digitorum superficialis]

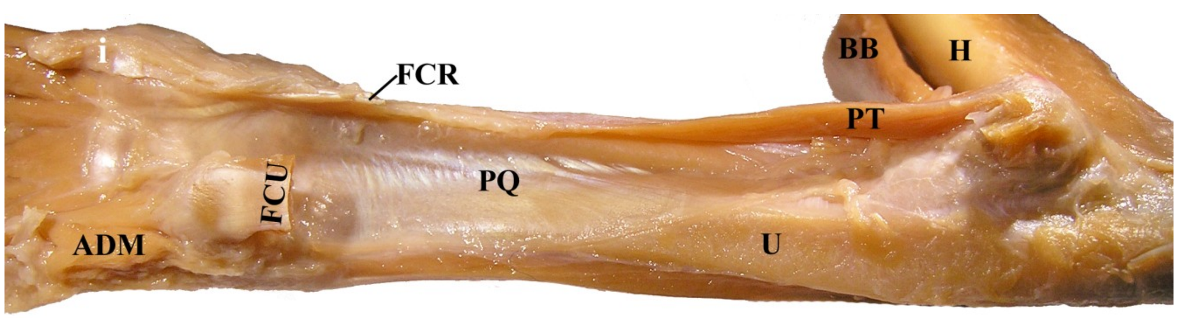


Figure 3.4B-22. Remnants of m. pronator quadratus, caudal view (P7183905).

[ADM- abductor digiti minimi, BB- biceps brachii, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, H- humerus, PT- pronator teres, PQ- pronator quadratus, U- ulna]

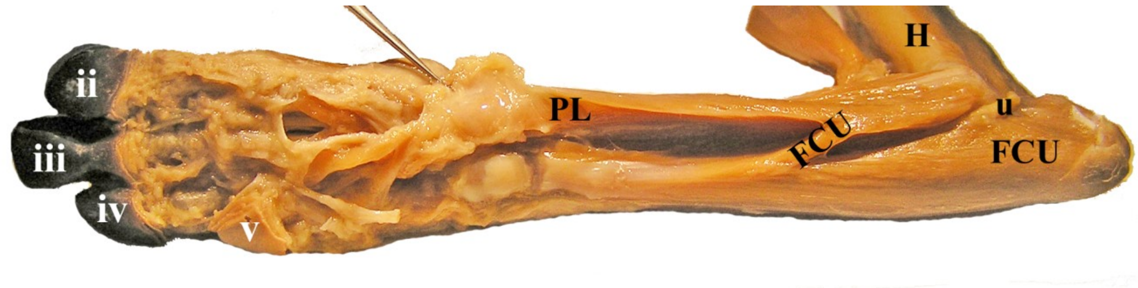
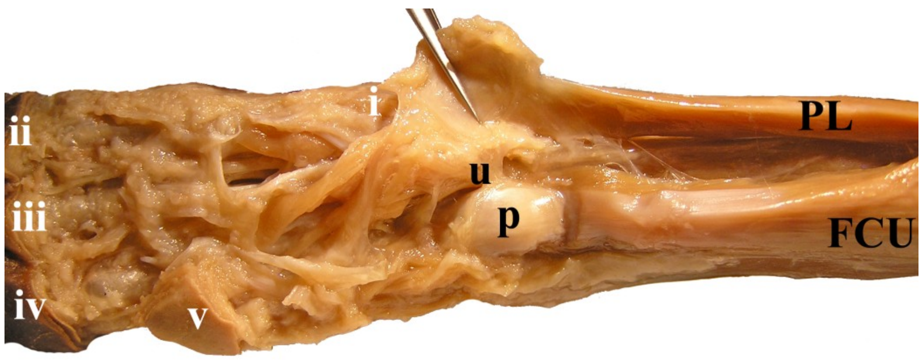


Figure 3.4B-23. M. flexor flexor carpi ulnaris, caudal view (P7173711).

[H- humerus, FCU- flexor carpi ulnaris, PL- palmaris longus, u- ulnar nerve]



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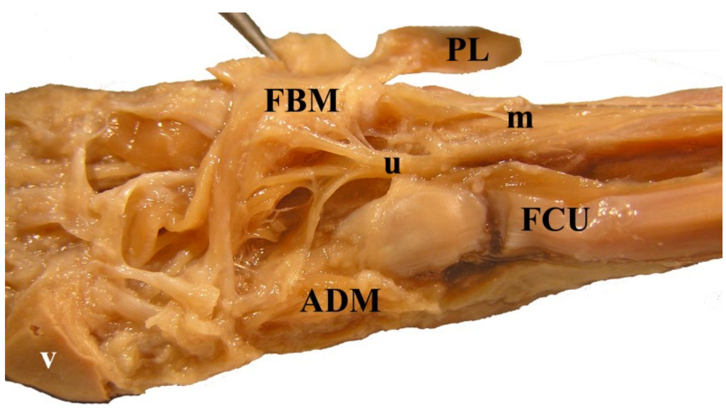

B.

Figure 3.4B-24. Fibrocartilaginous palmar aponeurosis.

A. M. palmaris longus inserting as palmar aponeurosis, at instrument tip (P7173716). B. Ulnar nerve in tunnel deep to palmar aponeurosis and innervating mm. flexor digitorum breves manus (P7173722).

[ADM- abductor digiti minimi, FBM- flexor digitorum breves manus, FCU- flexor carpi ulnaris, m- median nerve, p- pisiform, PL- palmaris longus, u- ulnar nerve]

M. MANUS GROUP – MEDIAN & ULNAR NERVES

mm. palmaris brevis, flexor digitorum breves manus^{m+u}, lumbricales^{m+u}, abductor digiti minimi^{u}, contrahentes^{u}, abductor pollicis brevis, flexor digitorum breves profundus^{u}

M. palmaris brevis is absent in *Heterohyrax.*

Mm. flexor digitorum breves manus is very large and strong in *Heterohyrax*. It has four bellies originating from the fibrocartilaginous palmar aponeurosis in the palm. The belly inserting on the pollex is rudimentary and barely visible. The belly inserting on the metacarpophalangeal joint of digit II is the largest, at 8 mm long and 3.5 mm wide, and clearly has median nerve innervation. The belly inserting on the metacarpophalangeal joint of digit IV is 2 mm wide, and has ulnar nerve innervation. The belly inserting on the metacarpophalangeal joint of digit V also originates partially from the deep surface of the belly for digit IV, and is also innervated by the ulnar nerve.

There are two mm. lumbricales. The medial originates between the tendons of m. flexor digitorum profundus for digits II and III and inserts on the medial side of the middle phalanx of digit III. The lateral originates between the tendons of m. flexor digitorum profundus for digits III and IV and inserts on the medial side of the middle phalanx of digit IV.

M. abductor digiti minimi is poorly preserved in the specimen, but appears to be normal with an origin from the pisiform and an insertion on the lateral side of metacarpal V. The pollex is represented only by a vestigial metacarpal I, thus m. abductor pollicis brevis is absent.

There are three mm. contrahentes in the manus. They originate from the cartilage and ligaments over the carpals and insert on the lateral side of digit II and the medial sides of digits IV and V.

Mm. flexor digitorum breves profundus are nine in number, one pair for each functional metacarpal and a single belly for the vestigial pollex. The pairs for digits II-V insert on the medial and lateral sides of the flexor apparatus. There is an additional m. flexor digitorum brevis profundus inserting on the lateral side of the base of the proximal phalanx of digit II, which is also observed in *Procavia* and *Orycteropus*. This muscle may be the remains of a proper pair of mm. flexor digitorum breves profundus for the vestigial pollex, and could perhaps act to adduct digit I and assist in the flexion of digit II. No opponens muscles are differentiated from mm. flexor digitorum breves profundus.

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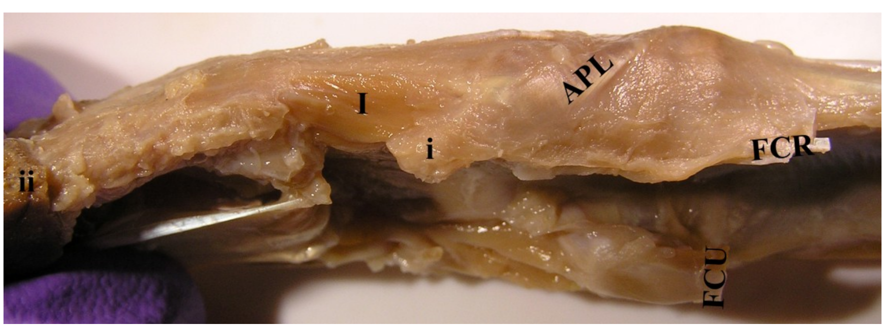
B. 

Figure 34.B-25. Right manus, medial view.

A. Pre-dissection (P7113595). B. Insertion of abductor pollicis longus (P7183901).

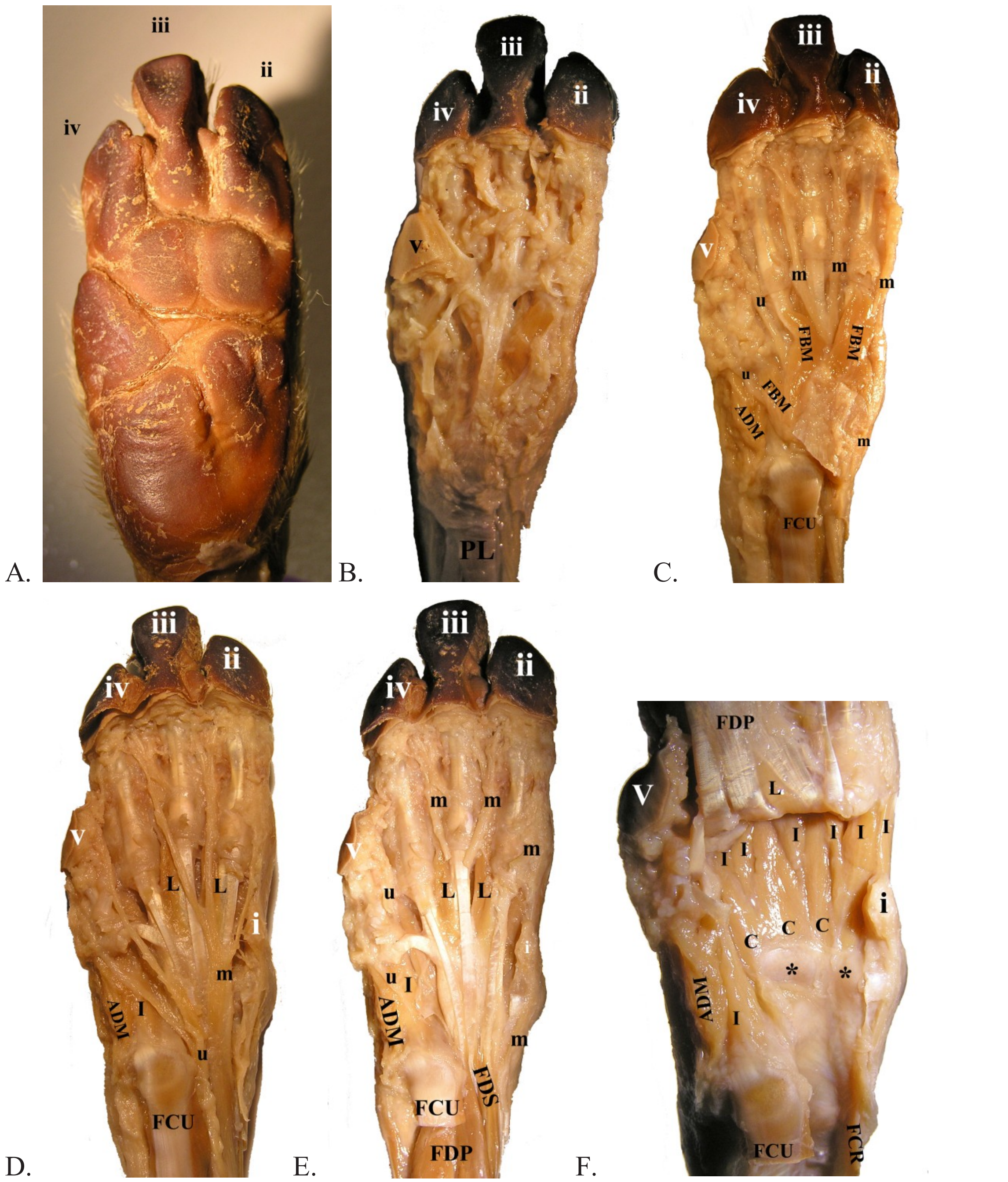
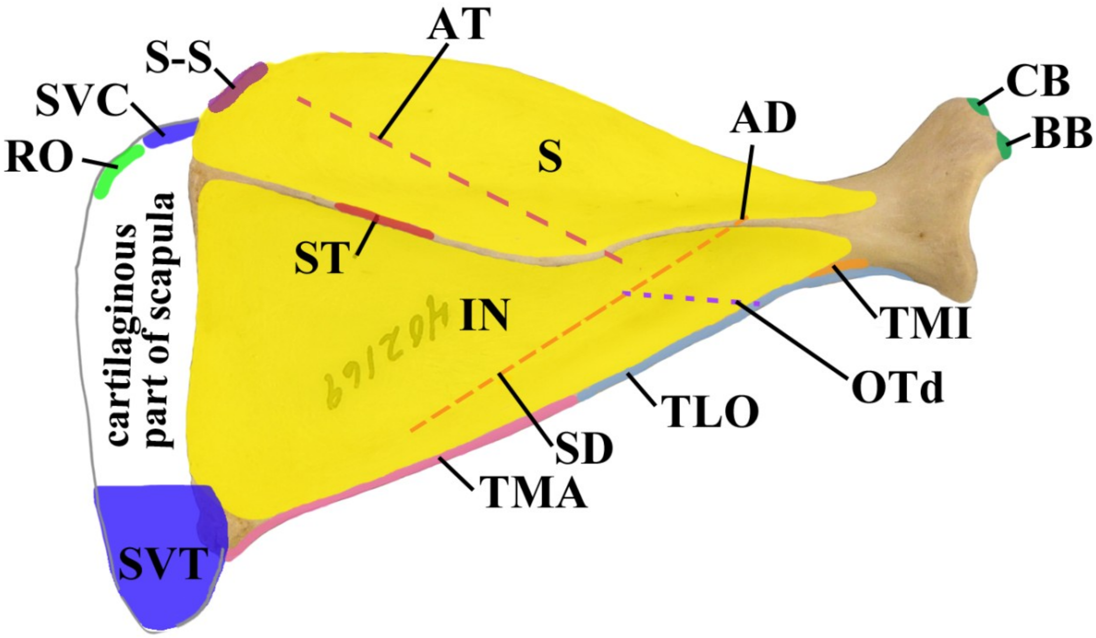


Figure 3.4B-26. Muscles of the manus. A. Right palm pre-dissection (P7123621). B. Palmar aponeurosis (P7163703). C. Mm. flexor digitorum breves manus (P7173724). D. Median and ulnar nerves (P7183774). E. Mm. lumbricales and long flexor tendons (P7183830). F. Mm. contrahentes and flexor digitorum breves profundus (P7183898).

[*- cartilaginous plate, ADM- abductor digiti minimi, C- contrahentes, FBM- flexor digitorum breves manus, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, FDP- flexor digitorum profundus, FDS- flexor digitorum superficialis, I- flexor digitorum breves profundus, L- lumbricales, m- median nerve, PL- palmaris longus, u- ulnar nerve]



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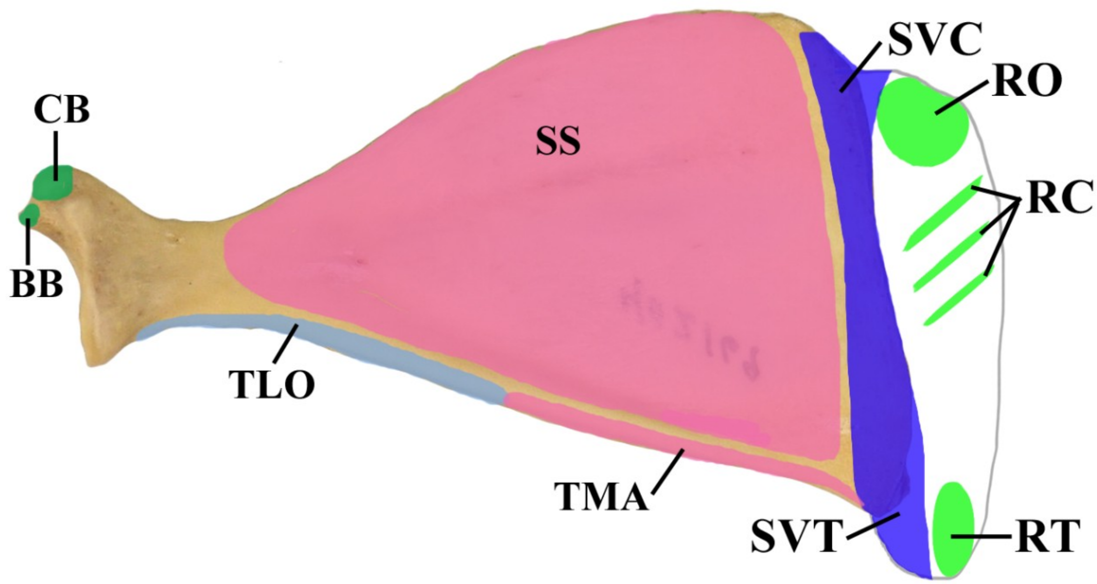


B.

Figure 3.4B-27. Muscle attachment maps for the scapula.

A. Superficial surface of the scapula. B. Deep surface of the scapula.

[AD- acromiodeltoideus, AT- acromiotrapezius, BB- biceps brachii, CB- coracobrachialis, IN- infraspinatus, OTd – dorsal portion of omotransversarius, S- supraspinatus, S-S- sternoscapularis, SS – subscapularis, SVC- serratus ventralis cervicis, SVT – serratus ventralis thoracis, RC- rhomboideus cervicis, RO- rhomboideus capitis, RT – rhomboideus thoracis, TLO- triceps brachii caput longum, TMA – teres major, TMI – teres minor]

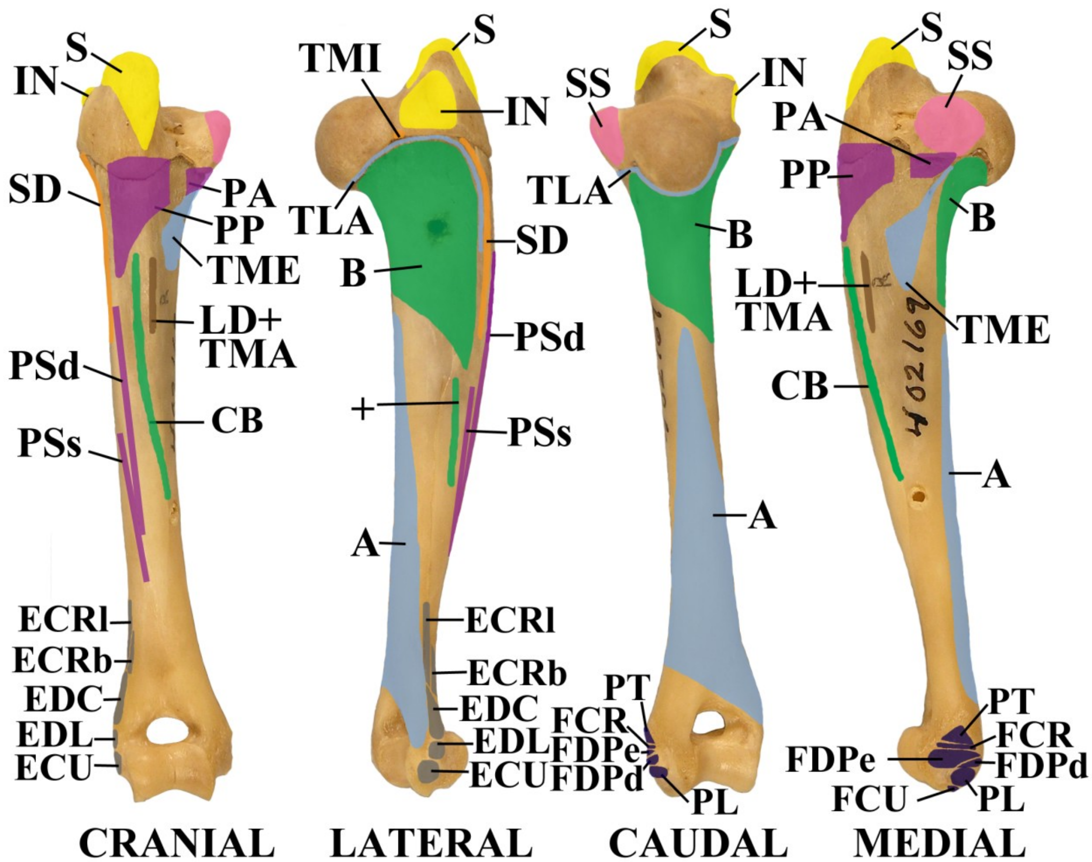


Figure 3.4B-28. Muscle attachment maps for the humerus.

[+ cubitalis, A- anconeus, B- brachialis, CB- coracobrachialis, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, FDPe- superficial portion of flexor digitorum profundus, FDPd- deep portion of flexor digitorum profundus, IN- infraspinatus, LD- latissimus dorsi, PL- palmaris longus, PP- pectoralis profundus, PSd- deep portion pectoralis superficialis, PSs- superficial portion of pectoralis superficialis, PT- pronator teres, S- supraspinatus, SD- spinodeltoideus, SS- subscapularis, TLA- triceps brachii caput laterale, TMA- teres major, TME- triceps brachii caput mediale, TMI- teres minor]

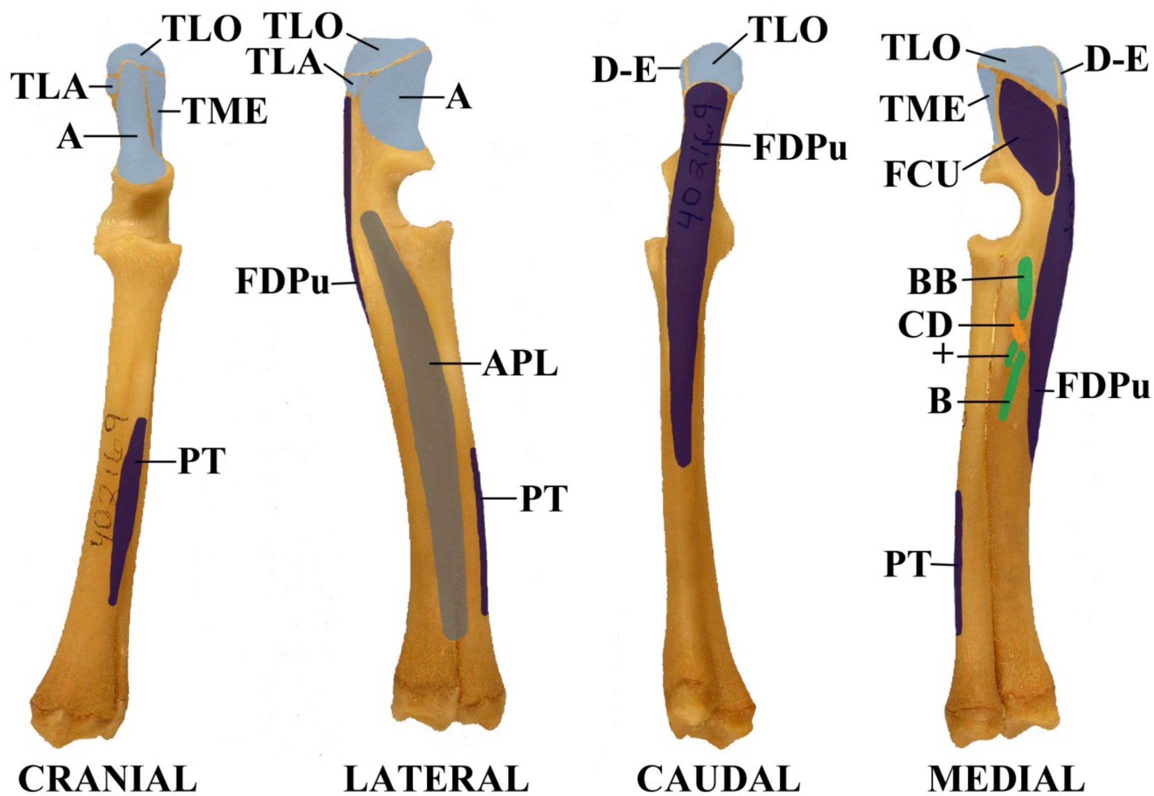


Figure 3.4B-29. Muscle attachment maps for the radius and ulna.

[+ cubitalis, A – anconeus, APL – abductor pollicis longus, B – brachialis, BB – biceps brachii, CD – clavodeltoideus, D-E – dorso-epitrochlearis, FDPu – ulnar head of flexor digitorum profundus, PT – pronator teres, TLA – triceps brachii caput laterale, TLO – triceps brachii caput longum TME – triceps brachii caput mediale]

3.5A – Artiodactyla – Tayassuidae – *Pecari tajacu*

This is a description of the extrinsic and intrinsic muscles of the forelimb of the collared peccary (Artiodactyla: Tayassuidae, *Pecari tacaju angulatus*). The right side of one juvenile female zoo specimen of unknown origin was dissected. The specimen (NMNH 541438) died at the San Diego Zoo and was preserved in 70% ethanol after necropsy. There was some damage to the specimen related to the necropsy: the neck was laterally flexed, the brachial plexus was severed, the pectoral musculature was dried and displaced, and the musculature was generally dry due to removal of the organs.

A few muscles of the forearm in a specimen of *Pecari* have been described previously by Campbell (1936).

Figure 3.5A-1. Pre-dissection photograph of *Pecari tajacu*, NMNH 541438, left side (PC200001).

0. CUTANEOUS MUSCULATURE

mm. cutaneous ventralis, sphincter colli, panniculus carnosus, dorsocutaneous

If present, m. cutaneous ventralis was destroyed by the necropsy.

M. sphincter colli extends down over the shoulder, where it becomes thicker.

M. panniculus carnosus muscle fibers extend longitudinally along the spine, 1 cm from the dorsal midline between the scapulae and only 1 mm from the dorsal midline more caudally. Proximally, the muscle ends by adhering to the fascia covering the junction of mm. infraspinatus and triceps brachii, and distally it ends in the inguinal crease. A slip of m. panniculus carnosus is adherent to m. latissimus dorsi in the axilla. Deep to m. panniculus carnosus are ten intercostal nerves, each 1 cm apart; the proximal eight nerves pierce m. latissimus dorsi and the caudal two nerves do not.

M. dorso-cutaneous is absent.

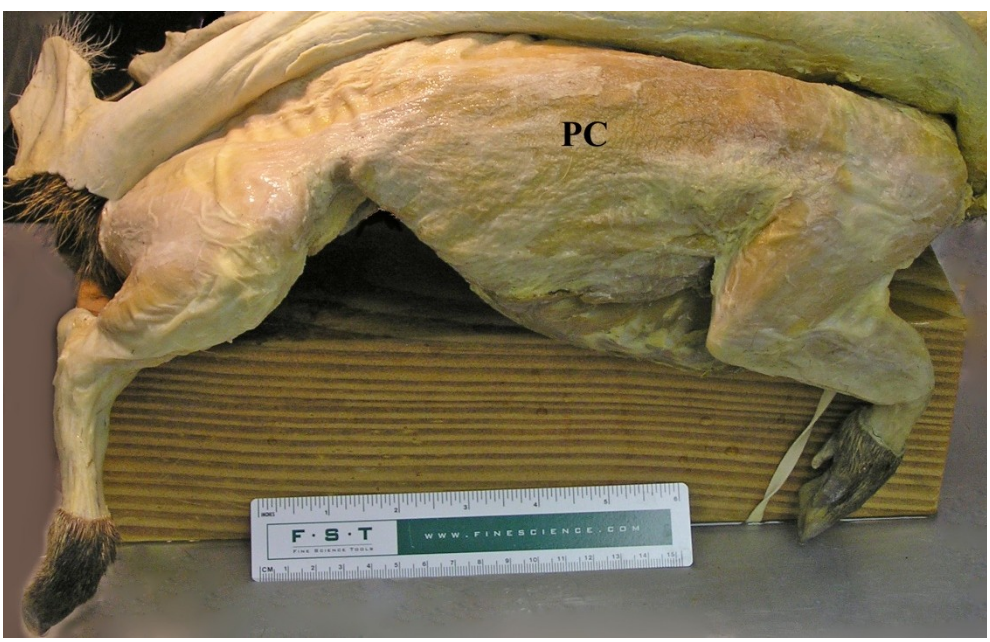


Figure 3.5A-2. M. panniculus carnosus [PC], lateral view (P1170002).

A. TRAPEZIUS GROUP – ACCESSORY NERVE and CERVICAL NERVES

mm. sternomastoideus, cleidomastoideus, clavotrapezius, acromiotrapezius, spinotrapezius

M. sternomastoideus was damaged during necropsy. Its origin was from the paroccipital process ventral to the origin of m. cleidomastoideus; presumably it inserts on the manubrium as in *Sus* (Sisson, 1914; Campbell, 1936). I was unable to ascertain whether m. sternomastoideus had a fibrous connection with the angle of the mandible as is the case in *Sus* (Campbell, 1936).

M. cleidomastoideus originates from the paroccipital process deep to m. sternomastoideus and ends at the clavicular intersection, deep and medial to the insertion of m. clavotrapezius. At the clavicular intersection mm. cleidomastoideus and clavotrapezius fuse with m. clavodeltoideus to form “m. brachiocephalicus.” The accessory nerve crosses superficial to m. cleidomastoideus and then passes deep to m. clavotrapezius, to the deep surface of m. acromiotrapezius.

M. clavotrapezius originates from the occipital crest superficial to m. rhomboideus capitis and fused with the cranial edge of m. acromiotrapezius. It ends at the clavicular intersection, where it joins with mm. cleidomastoideus and clavodeltoideus to form “m. brachiocephalicus.” The great auricular nerve emerges from between mm. cleidomastoideus and clavotrapezius.

M. acromiotrapezius takes origin from the occiput, ligamentum nuchae, and first thoracic vertebra. It ends as a 5 cm-wide expansion over the scapula; there is no connection to the spine of the scapula, instead it inserts only on the fascia covering m. supraspinatus. The cranial edge of m. acromiotrapezius is closely applied to m. omotransversarius, which inserts into the fascia over mm. deltoideus near the level of the neck of the scapula. The caudal edge of m. acromiotrapezius is connected to m. spinotrapezius by fascia.

M. spinotrapezius has a 6.5 cm origin along the thoracic spine, from the fourth through the tenth thoracic vertebrae, and from the thoracolumbar fascia. The muscle converges to a 1 cm tendon on its cranio-lateral edge, which inserts on the tuber spina.

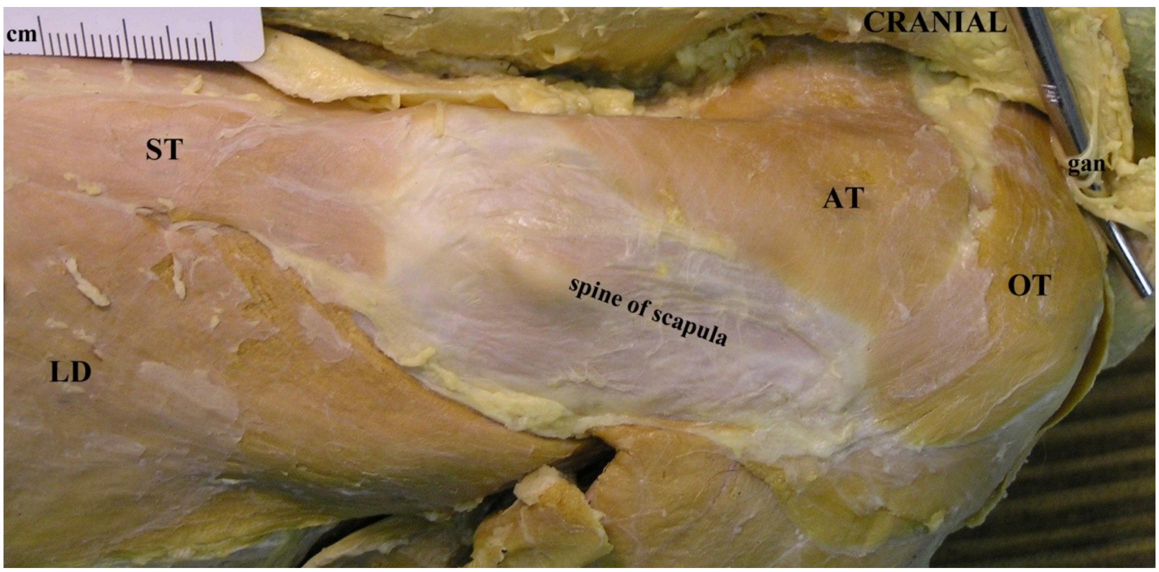


Figure 3.5A-3. Trapezius complex, lateral view. Great auricular nerve superficial to probe (P1220030).

[AT- acromiotrapezius, gan- great auricular nerve, LD- latissimus dorsi, OT- omotransversarius, ST- spinotrapezius]

B. RHOMBOID GROUP – DORSAL SCAPULAR NERVE

mm. rhomboideus capitis et cervicis, rhomboideus thoracis

M. rhomboideus capitis originates from the occiput about 5 mm cranial to the origin of m. rhomboideus cervicis, which originates from the cervical vertebrae. The two muscles fuse after 1 cm to form a muscle 3.5 cm wide. M. rhomboideus capitis et cervicis has a broad insertion on the deep surface of the cartilaginous portion of the scapula, extending from the cranial angle for two-thirds the length of the vertebral border.

M. rhomboideus thoracis originates from the proximal three thoracic vertebrae and inserts on the deep surface of both the cartilaginous and bony portions of the scapula near the caudal angle. It is a small and square muscle, slightly overlapped by the distal edge of m. rhomboideus capitis et cervicis.

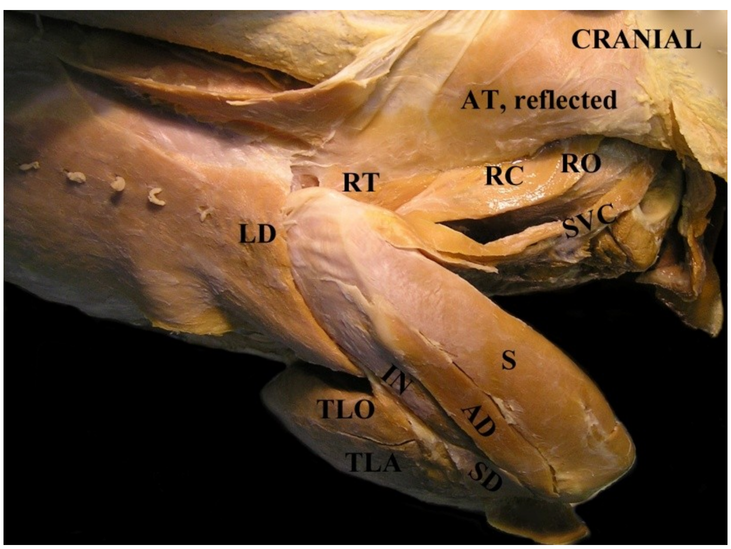


Figure 3.5A-4. Mm. rhomboideus, lateral view (P6120003).

[AD- acromiodeltoideus, AT- acromiotrapezius, IN- infraspinatus, RC- rhomboideus cervicis, RO- rhomboideus capitis, RT- rhomboideus thoracis, S- supraspinatus, SD- spinodeltoideus, SVC- serratus ventralis thoracis, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum]

C. OMO GROUP – CERVICAL NERVES, LONG THORACIC NERVE

mm. omotransversarius, omohyoideus, serratus ventralis (cervicis, thoracis)

M. omotransversarius originates from the transverse process of the atlas via a fine tendon, and emerges in the shoulder region as a flattened sheet of muscle between mm. clavotrapezius and acromiotrapezius. It travels closely applied to the cranial edge of m. acromiotrapezius and inserts into the fascia over mm. deltoideus and infraspinatus around the level of the neck of the scapula.

Any evidence of m. omohyoideus was destroyed by the necropsy, but the muscle is found in *Sus* (Windle & Parsons, 1901; Sisson, 1914).

M. serratus ventralis cervicis is damaged due to the necropsy, but it appears to be a robust sheet of muscle originating from cervical vertebrae 2-7. At 5 mm thick, it is much thicker than m. serratus ventralis thoracis. It tapers to a point and has a narrow triangular insertion on the cranial end of the deep surface of the vertebral border of the scapula at the junction between the cartilaginous and bony portions, proximal to the insertions of m. serratus ventralis thoracis and mm. rhomboideus. It also has a small insertion on the dorsal surface of the cranial angle of the scapula, and onto the fascia of mm. rhomboideus. The insertion is mixed fleshy and tendinous.

M. serratus ventralis thoracis is a big sheet of muscle, spanning from the first to eighth ribs, where it is quite thin, and extending up to a few fibers running with m. serratus ventralis cervicis. It inserts via fleshy fibers into the ventral surface of the bony portion of the scapula. The insertion is triangular, sweeping along the vertebral border and across the middle of the subscapular fossa where its position is marked by a faint ridge.

D. DELTOID GROUP – AXILLARY NERVE

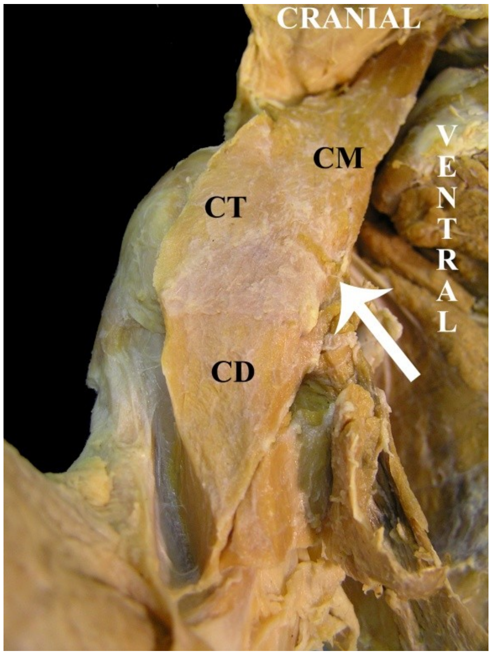
mm. clavodeltoideus, acromiodeltoideus, spinodeltoideus, teres minor

M. clavodeltoideus begins at the clavicular intersection, where it is continuous with mm. clavotrapezius and cleidomastoideus. Together the three muscles form the compound "m. brachiocephalicus." M. clavodeltoideus is 6 cm long, appearing flat in the horizontal plane, but this is true only at the shoulder. Near its insertion on the forearm the muscle is fairly robust in the vertical plane. It inserts on the cranio-lateral surface of the humerus, just lateral to the insertion of m. pectoralis superficialis and extending down to the ridge above the lateral epicondyle, where the bone is rugose.

M. acromiodeltoideus takes origin from the tuberosity on the spine of the scapula. It inserts on the cranial edge of a large depression on the lateral side of the greater tuberosity, deep to m. clavodeltoideus. In the Suidae, this muscle has been considered a division of m. supraspinatus (Campbell, 1936; Kneepkins et al., 1989). However, despite its rudimentary nature and strange insertion, the muscle appears to be homologous with the typical m. acromiodeltoideus of other artiodactyls (Windle & Parsons, 1901; Sisson, 1914; Campbell, 1936; Getty, 1975; Smuts & Bezuidenhout, 1987; Fisher et al., 2007).

M. spinodeltoideus is a somewhat divided, U-shaped muscle. Tendinous, thick fascia attaches the muscle to the caudal border of the scapula and expands over the fascia of mm. triceps brachii and teres major. The muscle inserts just lateral to m. pectoralis superficialis on the proximal end of the deltopectoral crest.

M. teres minor takes origin via very shiny, tendinous fibers from the proximal two-thirds of the caudal border and neck of the scapula. It inserts on the small tuberosity on the distal end of the large depression on the lateral side of the greater tuberosity.

A. 

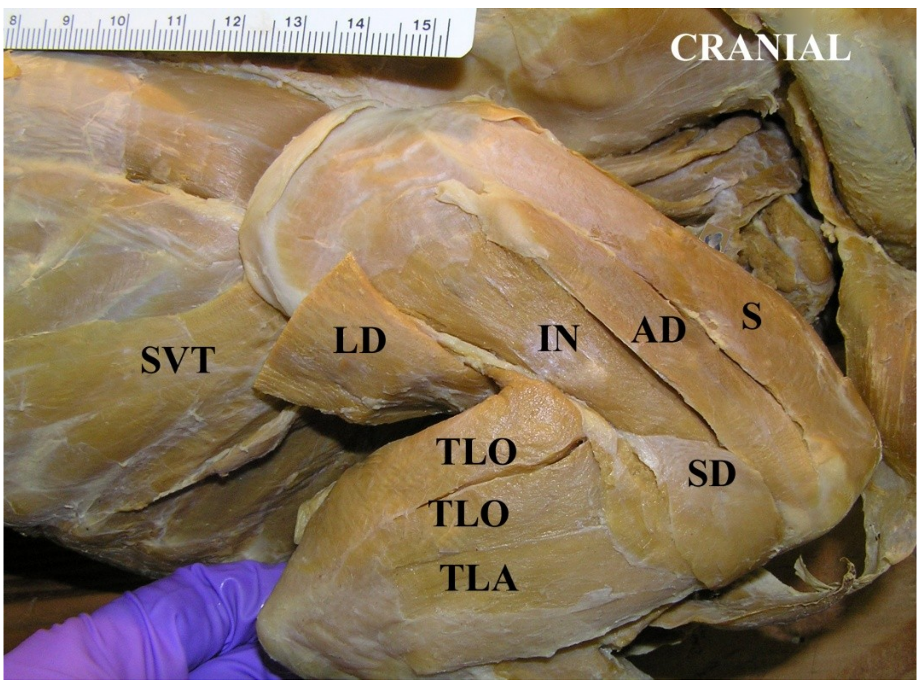
B. 

Figure 3.5A-5. Mm. deltoideus.

A. "M. brachiocephalicus," ventral view (P1230046). White arrow marks tendinous clavicular intersection. B. Lateral view (P6120011).

[AD- acromiodeltoideus, CD- clavodeltoideus, CM- cleidomastoideus, CT- clavotrapezius, IN- infraspinatus, LD- latissimus dorsi, S- supraspinatus, SD- spinodeltoideus, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, SVT- serratus ventralis thoracis]

E. SUBSCAPULARIS GROUP – SUBSCAPULAR NERVE

mm. subscapularis, teres major

M. subscapularis originates from half the subscapular fossa and the caudal border and neck of the scapula. It inserts via a stout tendon into the lesser tuberosity.

M. teres major originates from the caudal angle and along half of the caudal border of the scapula, overlapping 1.5 cm of the origin of m. teres minor. The muscle fascia expands and fuses with the cartilaginous portion of the scapula. M. teres major joins with m. latissimus dorsi, and the conjoined insertion on the medial humerus courses between the proximal ends of mm. triceps brachii caput mediale and anconeus.

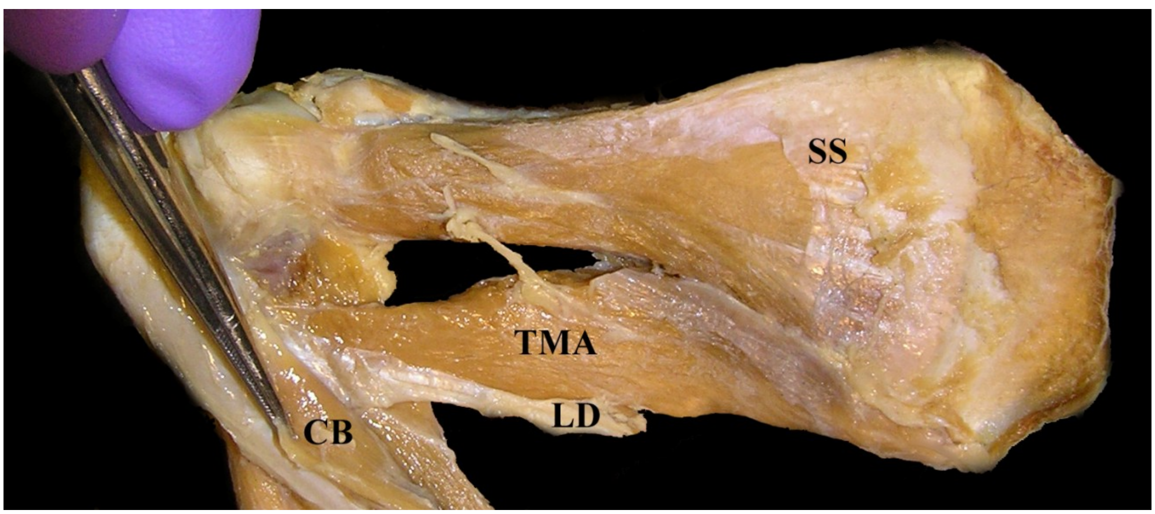


Figure 3.5A-6. Mm. subscapularis and teres major, deep surface of scapula (P6260038). [CB- coracobrachialis, LD- latissimus dorsi, SS- subscapularis, TMA- teres major]

F. LATISSIMUS GROUP – THORACODORSAL NERVE

m. latissimus dorsi

M. latissimus dorsi originates from the thoracolumbar fascia 1 cm lateral to the ninth thoracic to second lumbar vertebrae, although it appears that some fibers continue down to the iliac crest. It also originates from ribs 9-11 via fleshy fibers. The muscle is a relatively thin sheet but remains broad even to its insertion in fusion with m. teres major on the medial side of the humerus deep to mm. coracobrachialis and triceps brachii caput mediale.

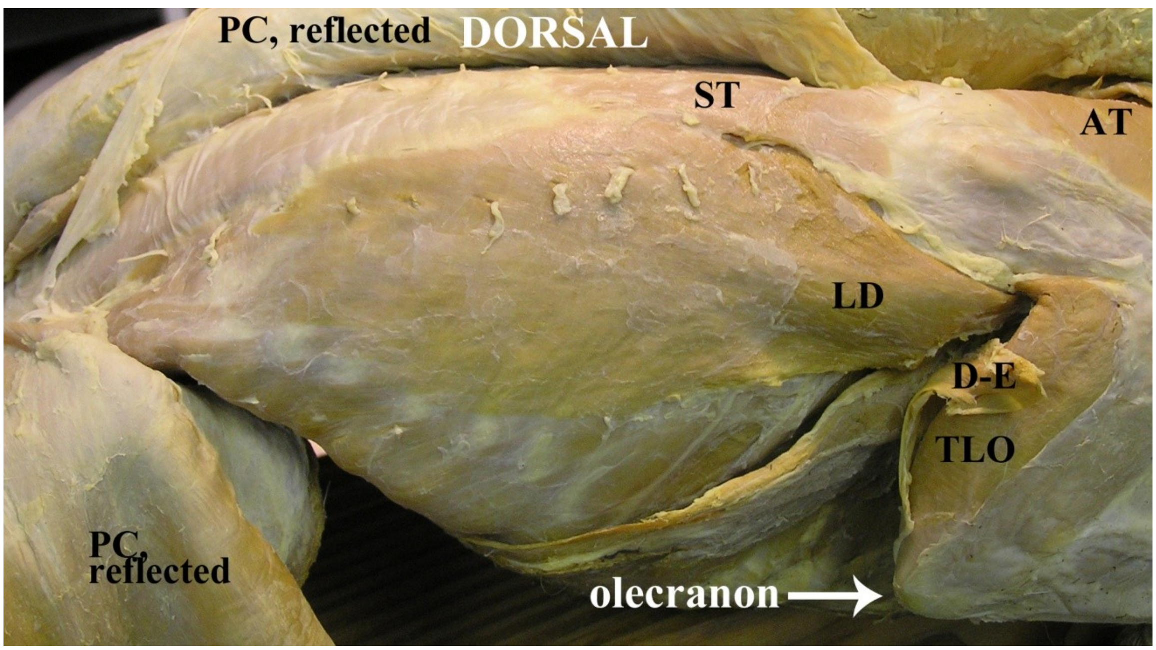


Figure 3.5A-7. M. latissimus dorsi, lateral view (P1180021).

[AT- acromiotrapezius, D-E- dorso-epitrochlearis, LD- latissimus dorsi, PC- panniculus carnosus, ST- spinotrapezius, TLO- triceps brachii caput longum]

G. PECTORALS and SUBCLAVIUS GROUP – PECTORAL NERVES

mm. pectoralis superficialis, pectoralis profundus, pectoralis abdominalis, sternoscapularis, subclavius

The origin of m. pectoralis superficialis was destroyed by the necropsy. The remnants are two thin and flat sheets of muscle: a superficial sheet, which is 1.5 cm wide, and a deep sheet, which is 3 cm wide. The two parts are contained in a 5 mm-thick fascia and are separable until just 3 mm before insertion, where they fuse into a thin tendinous sheet. The only fleshy insertion is the proximal 1 cm of the deeper layer. The insertion is between the insertions of mm. clavodeltoideus and coracobrachialis on the cranial aspect of the humerus.

M. pectoralis abdominalis was mostly destroyed by necropsy; there is only a vestige present as a thin layer of tissue inserting on the medial side of the elbow and arm in connection with m. pectoralis superficialis.

The origins of m. pectoralis profundus and m. sternoscapularis unfortunately were destroyed during necropsy. All that remained was a long, dried muscle mass adhering to the ribs but obviously displaced from origins, presumably from the ribs or sternum. Proximally, m. pectoralis profundus muscle inserts on the greater tuberosity of the humerus, while the fibers belonging to m. sternoscapularis are 1.2 cm wide and sweep over the greater tuberosity to insert via fleshy fibers into the fascia over m. supraspinatus.

M. subclavius is absent.

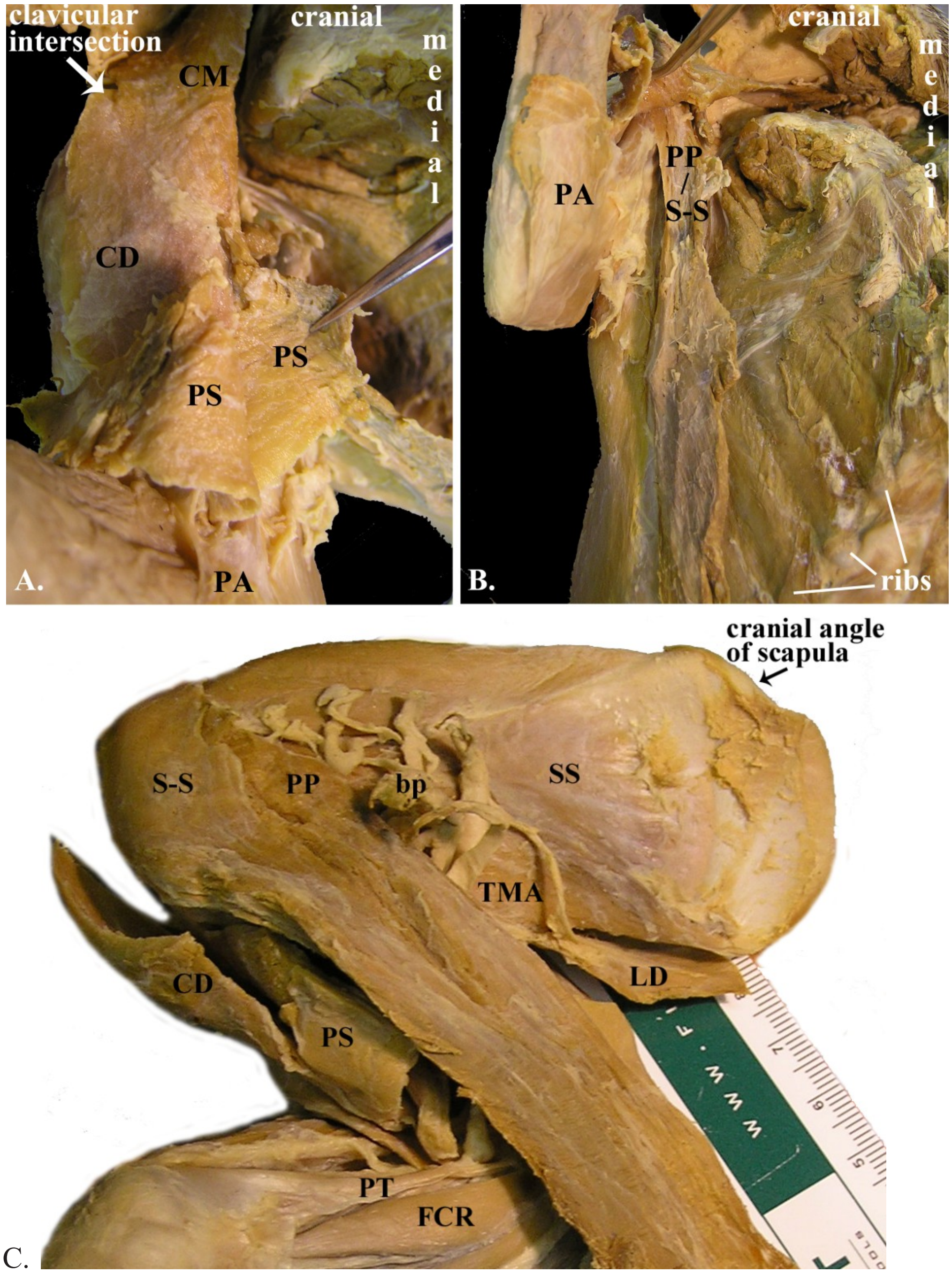


Figure 3.5A-8. Remnants of mm. pectoralis. A. Insertions of m. pectoralis superficialis, ventral view. B. M. pectoralis abdominalis, ventral view. C. Mm. pectoralis profundus et sternoscapularis insertions, medial view (P6160032).

[bp- brachial plexus, CD- clavodeltoideus, CM- cleidomastoideus, FCR- flexor carpi radialis, LD- latissimus dorsi, PA- pectoralis abdominalis, PP- pectoralis profundus, PS- pectoralis superficialis, PT- pronator teres, S-S- sternoscapularis, SS- subscapularis, TMA- teres major]

H. BICEPS GROUP – MUSCULOCUTANEOUS NERVE

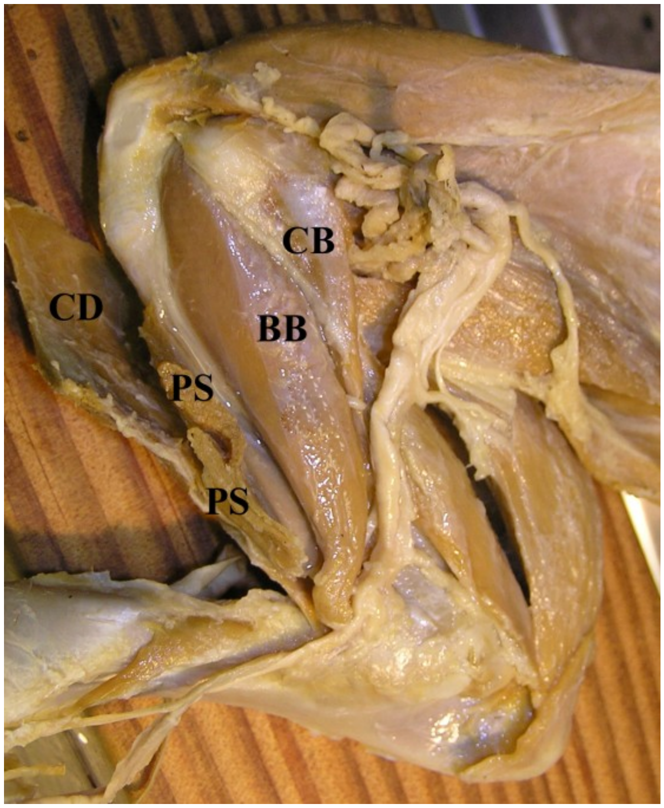
mm. coracobrachialis medius et profundus, biceps brachii, brachialis, articularis humeri

M. coracobrachialis has two portions, both innervated by the musculocutaneous nerve. The superficial portion, m. coracobrachialis medius, has a shiny tendinous origin from the coracoid process and then broadens to muscle fibers. A thick fascial band connects the fleshy part with the gleno-humeral joint capsule and the head of the humerus. It inserts via tendinous fascia into most of the medial surface of the humerus. The other portion, m. coracobrachialis profundus, is deep and quite small. It originates from m. coracobrachialis medius and inserts on the distal margin of the lesser tuberosity.

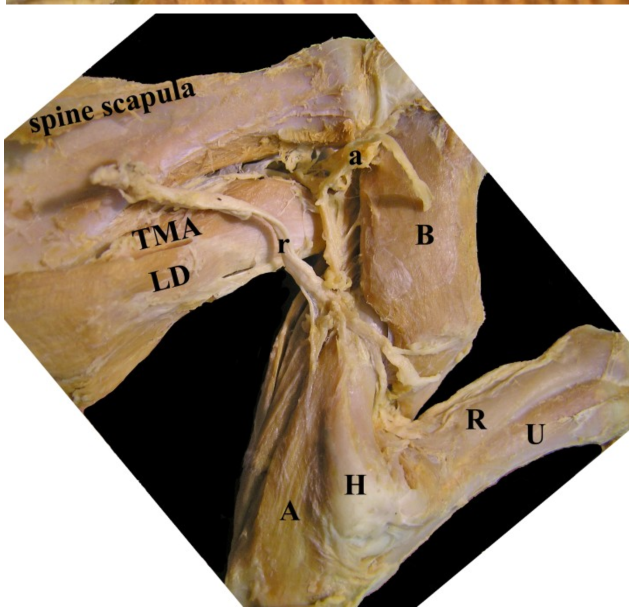
M. biceps brachii consists of a single belly which originates from the supraglenoid tubercle. The muscle is flat and covers most of the medial side of the humerus. It inserts on the head of the radius, but its tendinous expansion reaches the ulna.

M. brachialis originates from the caudal and lateral sides of the humerus beginning just distal to the humeral head and extending along the lateral edge of the deltopectoral crest. The muscle is robust and fleshy, but abruptly becomes a narrow tendon just before insertion. It inserts into a distinct tuberosity just distal to the small opening remaining between the fused radius and ulna, thus inserting on both bones but mainly the ulna. The muscle seems to receive innervation from the radial nerve rather than the musculocutaneous nerve. Windle & Parsons (1901) described median nerve innervation in *Pecari* and other artiodactyls.

M. articularis humeri is a few muscle fibers on the caudal surface of the gleno-humeral joint capsule.



A.



B.

Figure 3.5A-9. Muscles of the biceps group. A. Mm. biceps brachii and coracobrachialis, medial view (P6250004). B. M. brachialis, lateral view (P6260035).

[a- axillary nerve, A- anconeus, B- brachialis, BB- biceps brachii, CB- coracobrachialis, CD- clavodeltoideus, H- humerus, LD- latissimus dorsi, PS- pectoralis superficialis, r- radial nerve, R- radius, TMA- teres major, U- ulna]

I. SPINATI GROUP – SUPRASCAPULAR NERVE

mm. supraspinatus, infraspinatus

M. supraspinatus originates from the cranial surface of the spine of the scapula and the supraspinous fossa and the muscle belly rises high above the edge of the scapula. At the neck of the scapula there is no fleshy attachment, and the suprascapular nerve crosses over the scapula to enter m. infraspinatus. The insertion of m. supraspinatus is on the greater tuberosity of the humerus.

M. infraspinatus originates in the infraspinous fossa of the scapula. It forms a broad, flat tendon that inserts onto the proximal and cranial edges of the large depression on the lateral side of the greater tuberosity of the humerus.

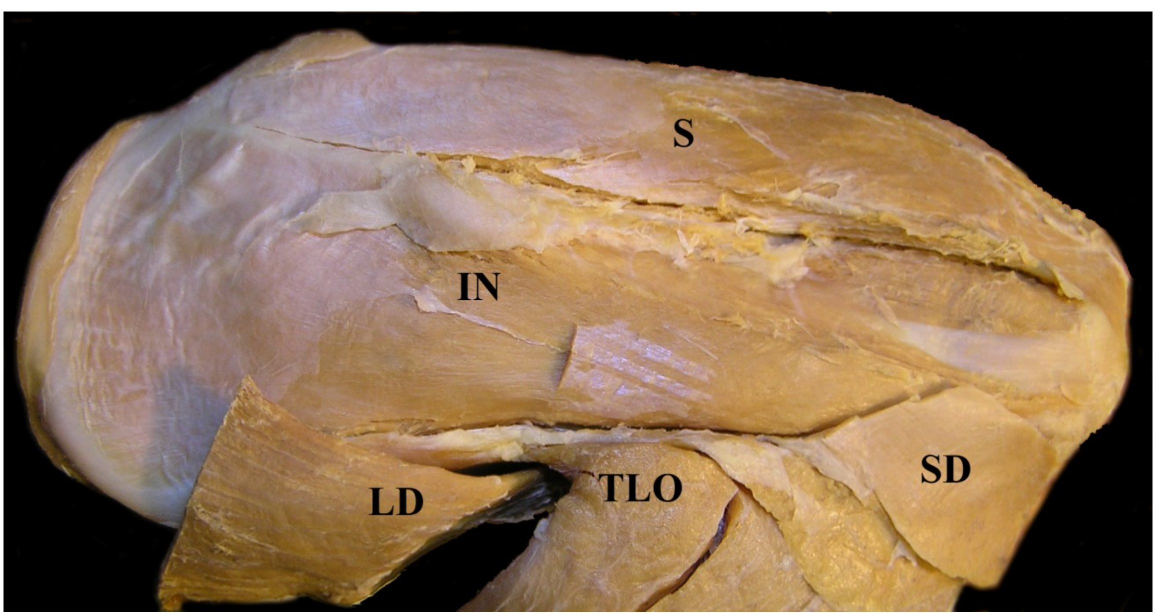


Figure 3.5A-10. Mm. supraspinatus and infraspinatus, lateral view (P6250009).

[IN- infraspinatus, LD- latissimus dorsi, S- supraspinatus, SD- spinodeltoideus, TLO- triceps brachii caput longum]

J. TRICEPS GROUP – RADIAL NERVE

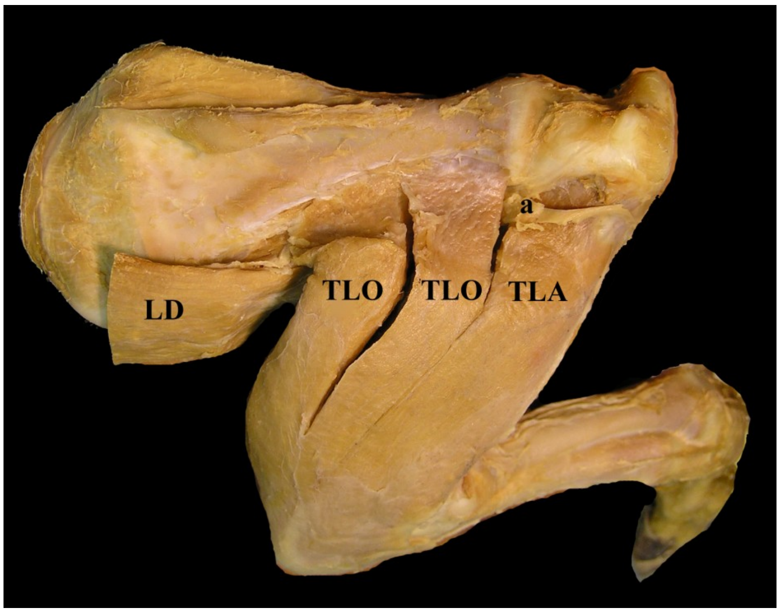
mm. dorso-epitrochlearis, triceps brachii (caput laterale, caput mediale, caput longum), anconeus

M. dorso-epitrochlearis muscle is mostly tough fascia which originates on m. latissimus dorsi and ends on the medial side of the olecranon.

M. triceps brachii caput laterale originates from the proximal end of the deltopectoral crest, just distal and caudal to the depression at the lateral side of the base of the greater tuberosity. It also originates from the lateral edge of the humeral head just outside the joint capsule. It is separated from m. triceps brachii caput longum by the axillary nerve. The muscle inserts on the lateral side of the olecranon.

There is very thick fascia around the origin of m. triceps brachii caput longum, which is doubled into two fully separable heads originating from half the length of the caudal border of the scapula. One originates from a rugose triangular area bordered by ridges on the neck of the scapula, whilst the other originates from the caudal border of the scapula. The muscles insert on the caudal and medial sides of the tip of the olecranon process of the ulna.

Mm. triceps brachii caput mediale and anconeus are fused, separated proximally by the tendon of insertion of mm. teres major and latissimus dorsi. The medial half of the conjoined muscle represents m. triceps brachii caput mediale, which has a fleshy origin on the caudo-medial surface of the humerus. The lateral half of the conjoined muscle is m. anconeus, which has a mixed tendinous and fleshy origin from the caudal aspect of the humerus. The parts join together and insert on their respective halves of the cranial surface of the olecranon. The radial nerve spirals over m. anconeus and passes deep to mm. triceps brachii. It emerges from the cranial edge of m. triceps brachii caput laterale and dives deep to m. extensor carpi radialis to pass into the forearm.

A. 

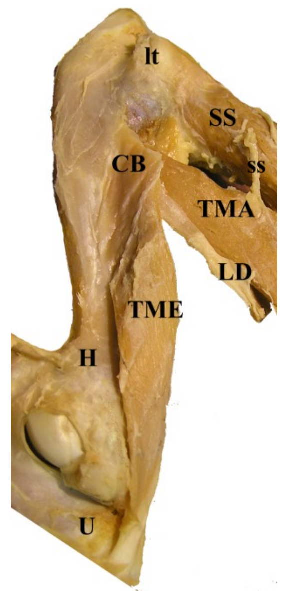
B. 

Figure 3.5A-11. Mm. triceps brachii. A. Lateral view (P6260030). B. Deep medial view (P6260039).

[CB- coracobrachialis insertion, H- humerus, LD- latissimus dorsi, lt- lesser tuberosity, ss- subscapular nerve, SS- subscapularis, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, TMA- teres major, TME- triceps brachii caput mediale, U- ulna]

K. EXTENSOR GROUP – RADIALNERVE

mm. brachioradialis, extensors carpi radialis, extensor digitorum communis, extensor digitorum lateralis, extensor carpi ulnaris, supinator, abductor pollicis longus, extensor digitorum profundus

M. brachioradialis is absent in *Pecari*.

M. extensor carpi radialis is a robust triangular muscle connected to m. brachialis by tough fascia. Many branches of the radial nerve emerge from beneath mm. triceps brachii and pass deep to the origin of m. extensor carpi radialis to enter the forearm. The muscle inserts in an expansion over the base of metacarpal III and its carpal.

M. extensor digitorum communis originates from the lateral epicondyle just distal to the origin of m. extensor carpi radialis and also from the elbow joint capsule. Its origin is mostly fleshy, and the muscle divides in the proximal third of the ulnar shaft into two fleshy bellies. The lateral belly is much smaller and becomes tendinous 1.5 cm proximal to the carpus, diving deep to end over the base of metacarpals III and IV. The larger medial belly becomes tendinous at the carpus and splits into two tendons. The lateral tendon travels down the center of the manus to the lateral side of digit III and the medial side of digit IV. The medial tendon goes to the medial side of digit III and sends a tiny tendon to digit II.

M. extensor digitorum lateralis originates as two bellies: a medial belly, which is three times larger, from the lateral epicondyle just distal to the origin of m. extensor digitorum communis, and a lateral belly from the ulna. The two bellies travel along the lateral side of the forearm and become tendinous 2 mm proximal to the carpus. The medial belly inserts on the lateral side of digit IV and the medial side of digit V. The smaller lateral belly inserts on the dorsum of metacarpal V, in connection with m. extensor carpi ulnaris.

M. extensor carpi ulnaris originates from the caudal surface of the lateral epicondyle, and is fleshy to the carpus. Its tendon inserts on the lateral side of the base of metacarpal V, with some connection to the insertion of the lateral belly of m. extensor digitorum lateralis. I did not observe the division described for *Pecari* by Campbell (1936), or the insertions into the hamate and metacarpal IV.

M. supinator is absent in *Pecari*.

M. abductor pollicis longus originates from the distal half of the ulna just medial to the very small origin of m. extensor digitorum profundus. It crosses over m. extensor carpi radialis and inserts onto the base of metacarpal II.

M. extensor digitorum profundus is a 3-mm ribbon of muscle that arises delicately from the middle third of the ulna just lateral to the origin of m. abductor pollicis longus. It travels deep to m. extensor digitorum communis and becomes tendinous as it crosses the carpus. In the manus it travels along the medial edge of the tendon of m. extensor digitorum communis to insert on the distal end of the proximal phalanx of digit II.

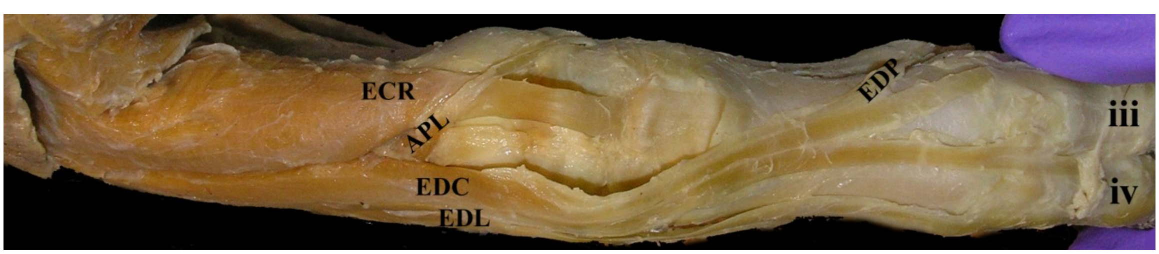


Figure 3.5A-12. M. extensor carpi radialis, cranial view (P6180044).

[APL- abductor pollicis longus, ECR- extensor carpi radialis, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, EDP- extensor digitorum profundus]

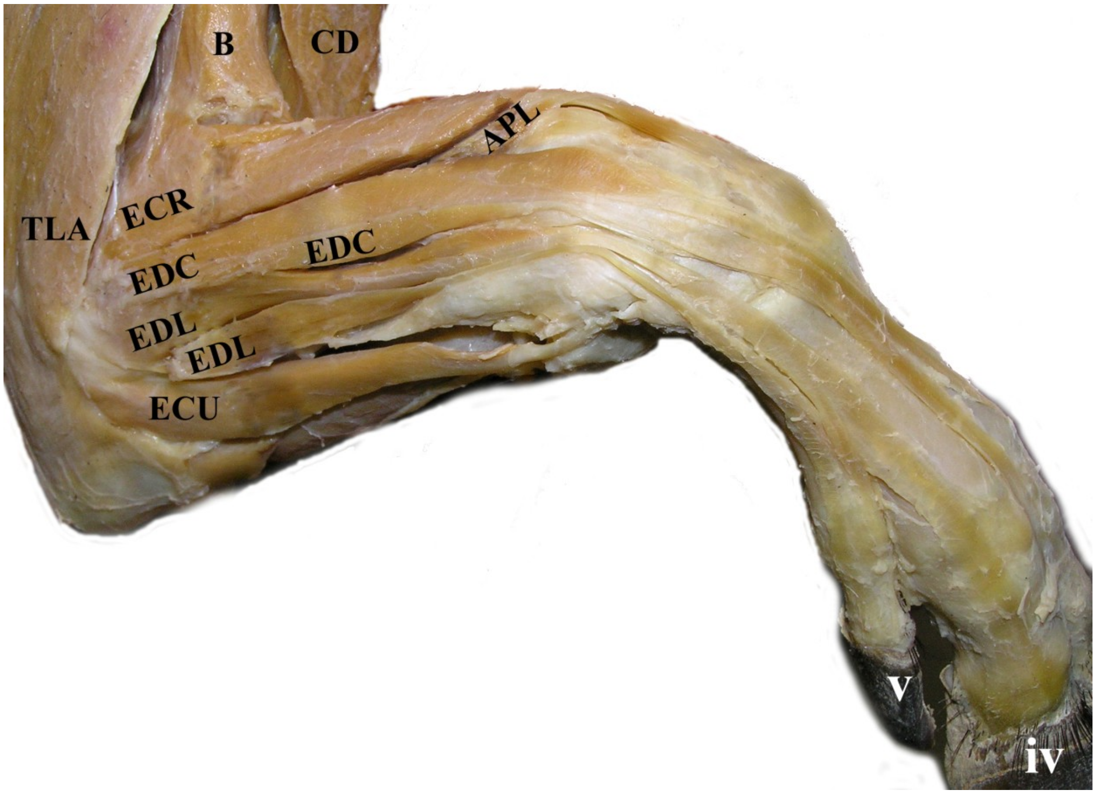


Figure 3.5A-13. Muscles originating from the lateral epicondyle, cranio-lateral view (P6180051).

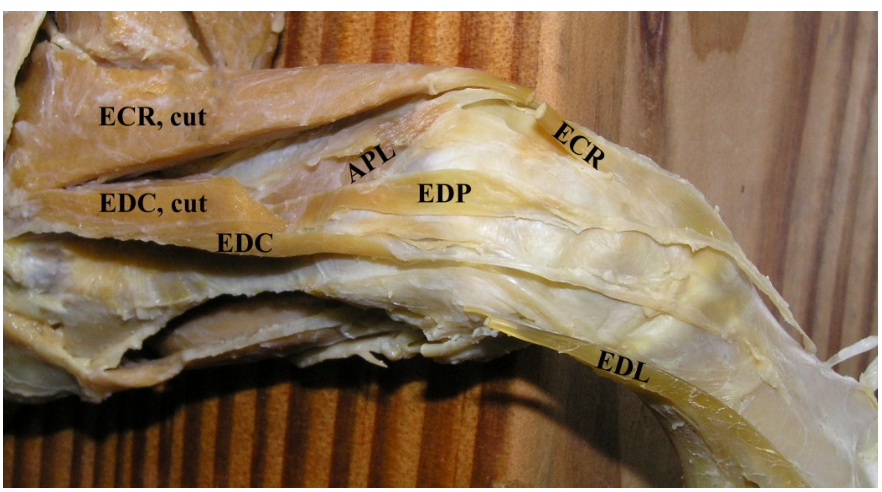
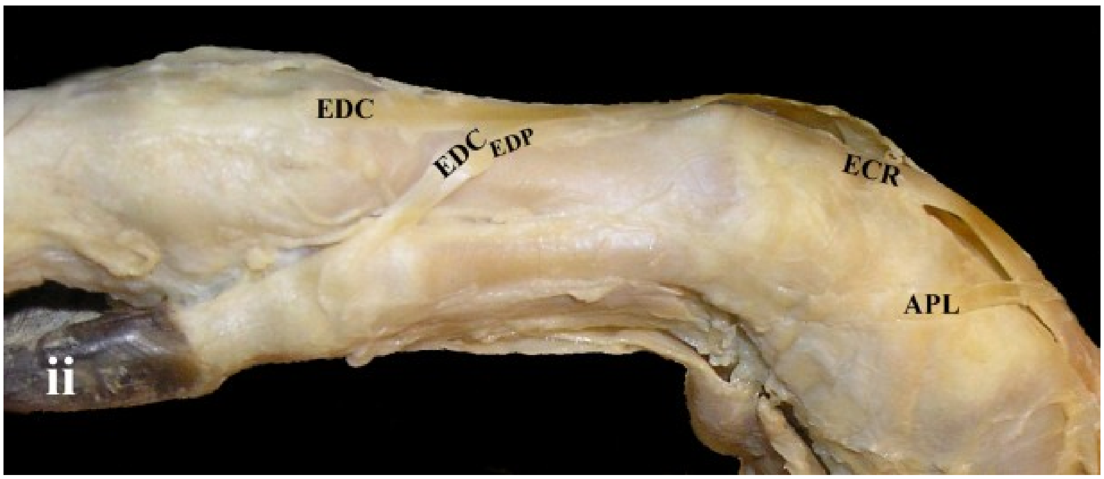


Figure 3.5A-14. M. extensor digitorum profundus, cranio-lateral view (P6200062).

[APL- abductor pollicis longus, B- brachialis, CD- clavodeltoideus, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, EDP- extensor digitorum profundus, TLA- triceps brachii caput laterale]

A. 

B. 

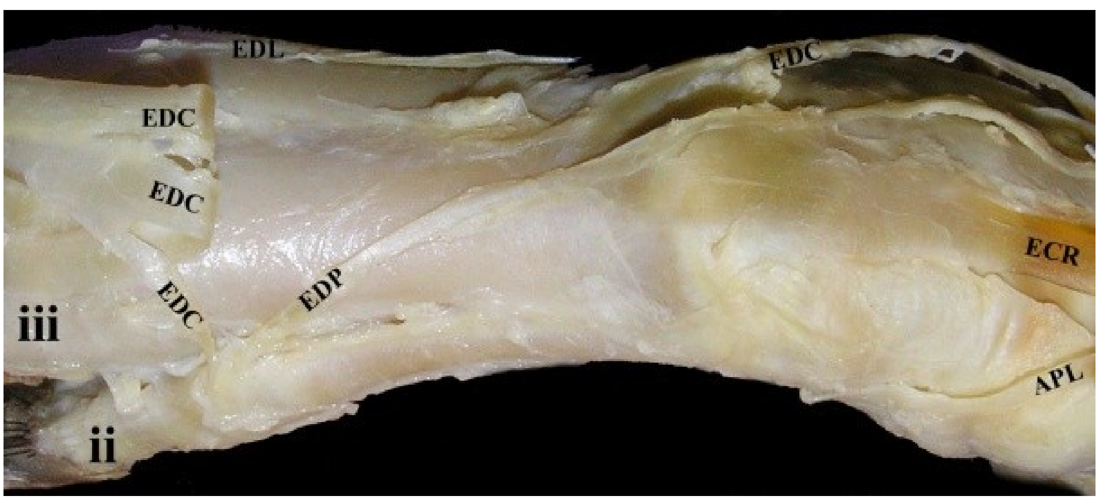
C. 

Figure 3.5A-15. Extensor tendons in the manus.
A. Dorsum of manus (P6180052). B. Superficial medial manus (P6180046). C. Deep dorso-medial view (P6200065)

[APL- abductor pollicis longus, ECR- extensor carpi radialis, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, EDP- extensor digitorum profundus]

L. FLEXOR GROUP – MEDIAN and ULNAR NERVES

mm. pronator teres^{m}, flexor carpi radialis^{m}, palmaris longus^{m}, flexor digitorum superficialis^{m}, interflexorii, flexor digitorum profundus^{m+u}, flexor carpi ulnaris^{u}, epitrochleo-anconeus, pronator quadratus

M. pronator teres has a tendon of origin on the medial epicondyle which bridges the median nerve as it enters the forearm. It becomes fleshy there, though it is encased in tough shiny fascia that binds the fleshy fibers to the middle third of the radius. The muscle inserts via tendinous fibers for 1 cm along the cranial surface of the distal third of the radius.

M. flexor carpi radialis has a fleshy origin from the medial epicondyle. It becomes a tendon at the carpus, where it passes deep to a tough retinaculum along metacarpal II, and travels into the deep palm. It inserts on the base of the palmar surface of metacarpal III.

I believe that mm. flexor digitorum superficialis and palmaris longus have been misidentified in the literature on artiodactyls. It has long been stated that the only artiodactyls with m. palmaris longus are hippos (Kajava, 1923; Fisher et al, 2007). In hippos, m. palmaris longus originates between m. flexor digitorum superficialis and m. flexor carpi ulnaris, and ends by fusing with mm. flexor digitorum brevis manus, which is perforated by the tendons of m. flexor digitorum profundus for digits IV and V (Campbell, 1936). *Sus* has been described as having two bellies of origin of m. flexor digitorum superficialis (Sisson, 1914; Campbell, 1936; Getty, 1975), one of which corresponds with the location of m. palmaris longus in the hippo. It appears that in artiodactyls other than hippos, m. palmaris longus has fused completely with mm. flexor digitorum brevis manus, resulting in a single distal tendon perforated by the tendon of m. flexor digitorum profundus for digit IV. Based on my dissections, the muscle identified here as m. palmaris longus in both *Pecari* and *Tragulus* does not pass deep to the flexor retinaculum, but is perforated by the tendon of m. flexor digitorum profundus for digit IV. M. flexor digitorum superficialis passing superficial to the flexor retinaculum would be highly unusual, as would m. palmaris longus forming a perforated tendon for m. flexor digitorum profundus. However, the otherwise absent mm. flexor digitorum brevis manus is very likely the source of the flexor sheath. The following descriptions reflect this interpretation.

M. flexor digitorum superficialis originates via fleshy fibers from the radial side of the tendon of the deep epicondylar belly of m. flexor digitorum profundus. Other authors have considered this small muscle "m. interflexorii" and confused what I interpret as m. palmaris longus with m. flexor digitorum superficialis (Kneepkins et al., 1989). The situation is definitely unclear, as each distal tendon is perforated by a tendon of m. flexor digitorum profundus. However, only the portion I identify as m. flexor digitorum superficialis passes deep to the flexor retinaculum, cupped in the U-shaped conjoined tendon of m. flexor digitorum profundus. M. flexor digitorum superficialis becomes a tendon that is perforated by the tendon of m. flexor digitorum profundus for digit III.

Campbell (1936) described two "m. interflexorii" for *Sus* and *Pecari*, and Kneepkins et al. (1989) found two in *Babyrousa;* I observed only one small connection between m. flexor digitorum superficialis and the radial head of m. flexor digitorum profundus.

M. palmaris longus originates directly from the medial epicondyle of the humerus together with the superficial epicondylar belly of m. flexor digitorum profundus. Its tendon is perforated by the tendon of m. flexor digitorum profundus for digit IV. This unusual formation of flexor sheath by m. palmaris longus may be the result of complete fusion with mm. flexor digitorum brevis manus, which often is perforated by the tendons of m. flexor digitorum profundus for digits IV or V.

The median nerve runs down the deep surface of m. flexor digitorum superficialis, and emerges between the tendons of m. flexor digitorum profundus for digits III and IV.

M. flexor digitorum profundus has four heads of origin. The superficial epicondylar belly of m. flexor digitorum profundus has a large, U-shaped origin from the distal medial margin of the medial epicondyle. This origin is deep to the origin of m. flexor carpi ulnaris and shared with m. palmaris longus. It forms the bulk of the flexor digitorum profundus muscle. The deep epicondylar belly of m. flexor digitorum profundus originates just distal to the superficial epicondylar belly. It gives origin to m. flexor digitorum superficialis, and ends on the medial edge of the conjoined flexor tendon. The radial portion of m. flexor digitorum profundus is a long flat belly that originates from the medial side of the radius. It inserts on the deep surface of the conjoined flexor tendon. The humeral and radial origins of m. flexor digitorum profundus are innervated by the median nerve. The ulnar portion of m. flexor digitorum profundus has a small triangular origin from the medial surface of the olecranon, and becomes tendinous before midshaft. The very long tendon adheres to the deep surface of the superficial epicondylar portion of m. flexor digitorum profundus, eventually joining the conjoined flexor tendon. This portion of the muscle is innervated by the ulnar nerve.

The four portions of m. flexor digitorum profundus fuse to a U-shaped flexor tendon which cups the tendon of m. flexor digitorum superficialis through the carpus. This is similar to the situation in *Babyrousa* (Kneepkins et al., 1989). The conjoined tendon divides over the metacarpals, with a smaller tendon to digit V given off about 1 cm before the larger tendons to digits III and IV. The tendon for digit III pierces through a tendon formed by m. palmaris longus, and the tendon for digit IV pierces through a tendon of m. flexor digitorum superficialis at the level of the middle phalanx. There is no tendon of m. flexor digitorum profundus to digit II.

<u>M. flexor carpi ulnaris</u> has only one belly. It has a broad, mixed fleshy and tendinous origin from the distal edge of the medial epicondyle of the humerus, between the origins of mm. flexor carpi radialis and flexor digitorum profundus. Its pinnate belly becomes a tendon 1.5 cm before it inserts into an expansion over the projecting pisiform. The ulnar nerve runs along the medial edge of the muscle.

<u>M. epitrochleo-anconeus</u> is absent. The <u>ulnar nerve</u> is protected instead by the tough white fascia coating the flexor musculature of the forearm. The nerve passes medial to the pisiform but superficial to the flexor retinaculum. In the manus it innervates mm. flexor digitorum breves profundus and provides sensory innervation to digit V.

<u>M. pronator quadratus</u> is absent in *Pecari*.

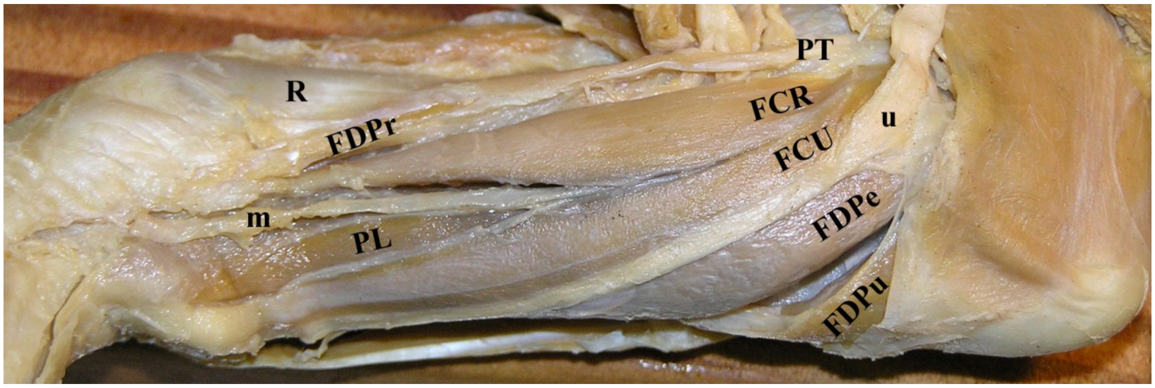


Figure 3.5A-16. Muscles originating from the medial epicondyle, medial view (P6180038).

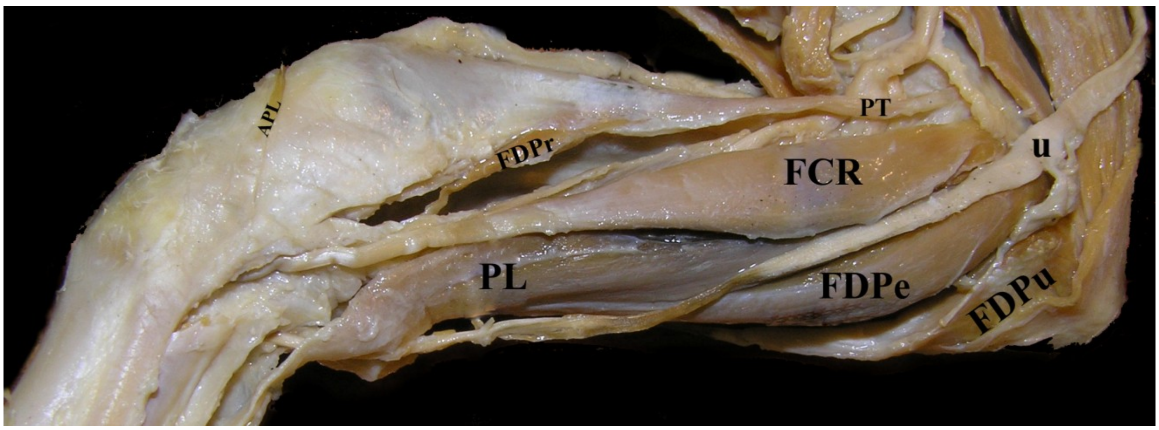


Figure 3.5A-17. M. palmaris longus, cranio-medial view (P6240008).

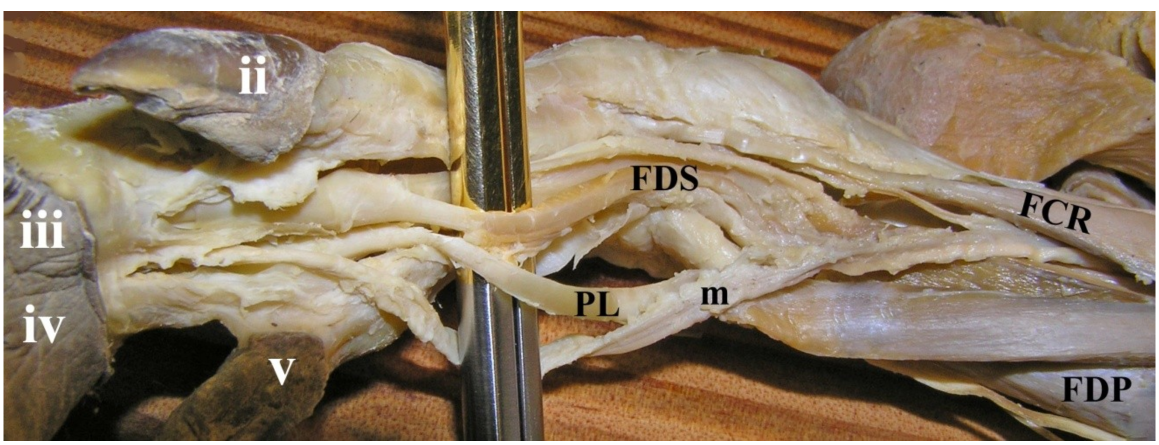


Figure 3.5A-18. M. flexor digitorum superficialis, caudal view (P6240015).

[APL- abductor pollicis longus, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, FDPe- superficial epicondylar belly of flexor digitorum profundus, FDPr- radial belly of flexor digitorum profundus, FDPu- ulnar belly of flexor digitorum profundus, m- median nerve, PL- palmaris longus, PT- pronator teres, u- ulnar nerve]

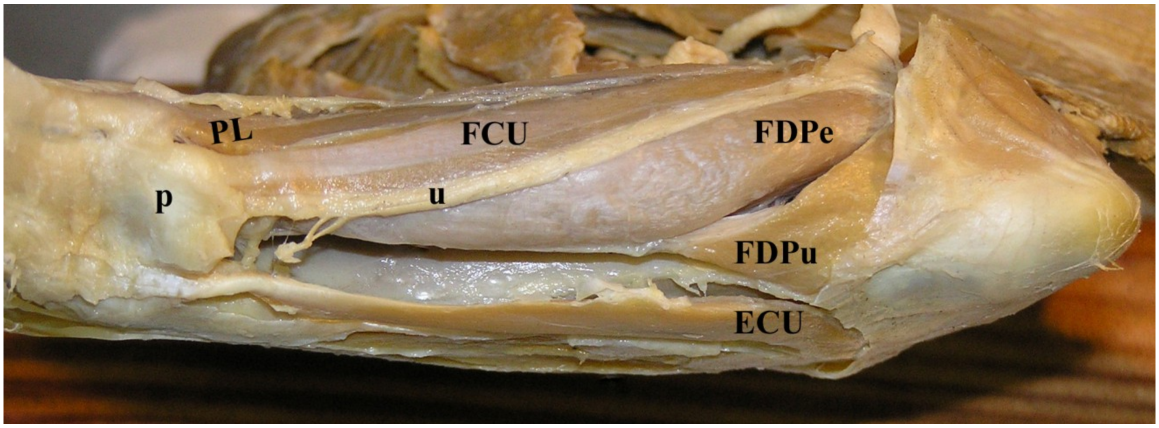


Figure 3.5A-19. M. flexor carpi ulnaris and ulnar nerve, caudal view (P6180041).

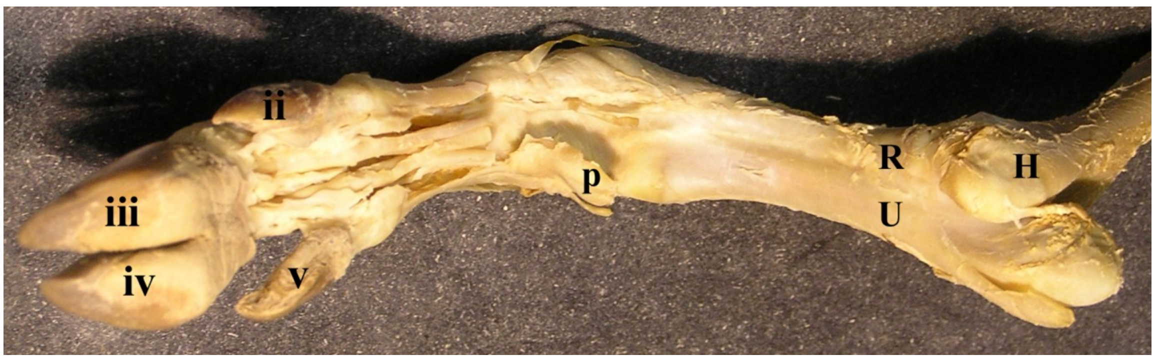


Figure 3.5A-20. Fused radius and ulna showing absence of m. pronator quadratus (P8280035).

[ECU- extensor carpi ulnaris, FCU- flexor carpi ulnaris, FDPe- superficial epicondylar belly of flexor digitorum profundus, FDPu- ulnar belly of flexor digitorum profundus, H- humerus, p- pisiform, PL- palmaris longus, R- radius, u- ulnar nerve, U- ulna]

M. MANUS GROUP – MEDIAN and ULNAR NERVES

palmaris brevis, flexor digitorum breves manus, lumbricales, abductor digiti minimi, contrahentes[u], abductor pollicis brevis, flexor digitorum breves profundus[u]

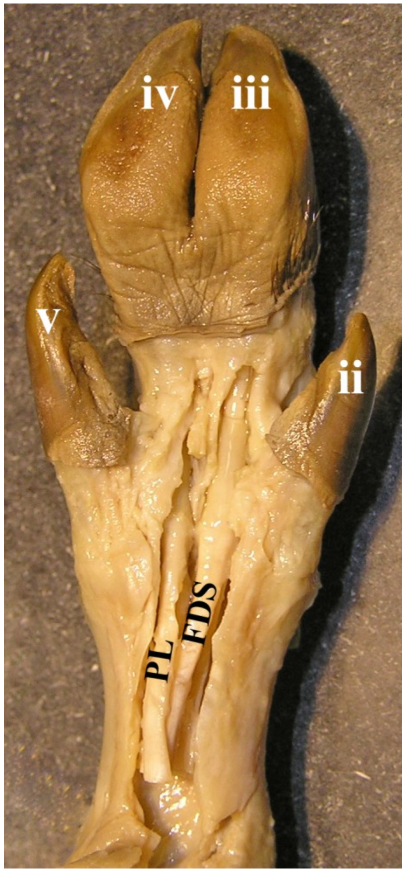
M. palmaris brevis and m. flexor digitorum breves manus are absent in *Pecari.*

Mm. lumbricales are represented by a few fibers situated between the larger tendons of m. flexor digitorum profundus for digits III and IV.

M. abductor digiti minimi is absent in *Pecari* or represented by the thickened fascia on the lateral surface of digit V. The pollex is absent in *Pecari*, as is m. abductor pollicis brevis.

There are two mm. contrahentes in the manus. They originate fleshily from the ligaments over the palmar surface of the carpus. One originates over metacarpal IV and inserts on the medial side of digit V. The other originates over metacarpal III and inserts via a tiny tendon onto the lateral side of the metacarpophalangeal joint of digit II.

There are eight mm. flexor digitorum breves profundus. A pair is found on each metacarpal, but the pairs are separable only distally. The muscles consist of mixed fleshy and tendinous fibers that originate from the palmar surface of the carpus and from the five cartilaginous septa on the medial and lateral sides of each digit. They insert on the metacarpophalangeal joints of digits II-V. The pair for digit III are the largest, and the pair for digit II are the smallest. No opponens muscles are differentiated from mm. flexor digitorum breves profundus.

A.


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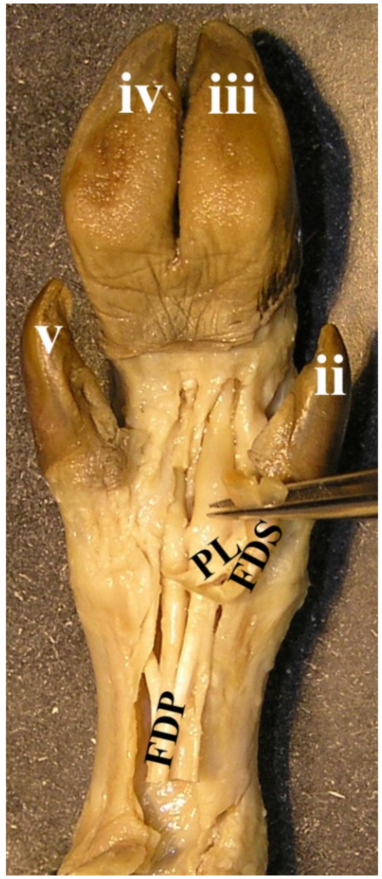

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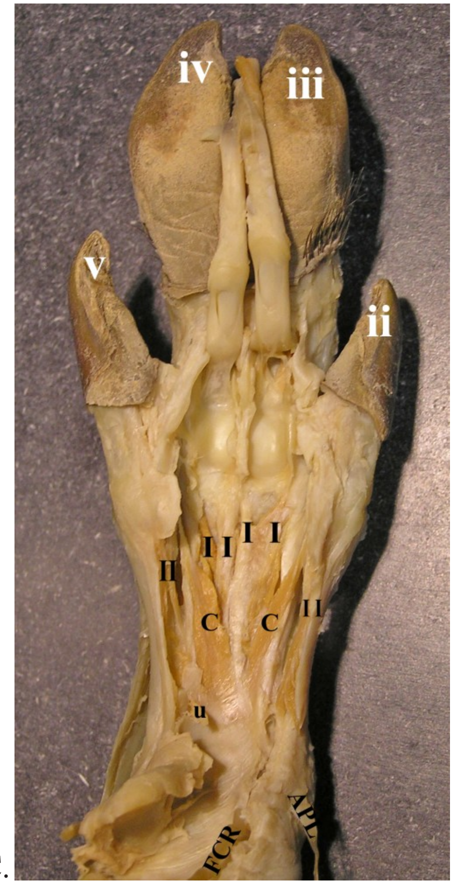
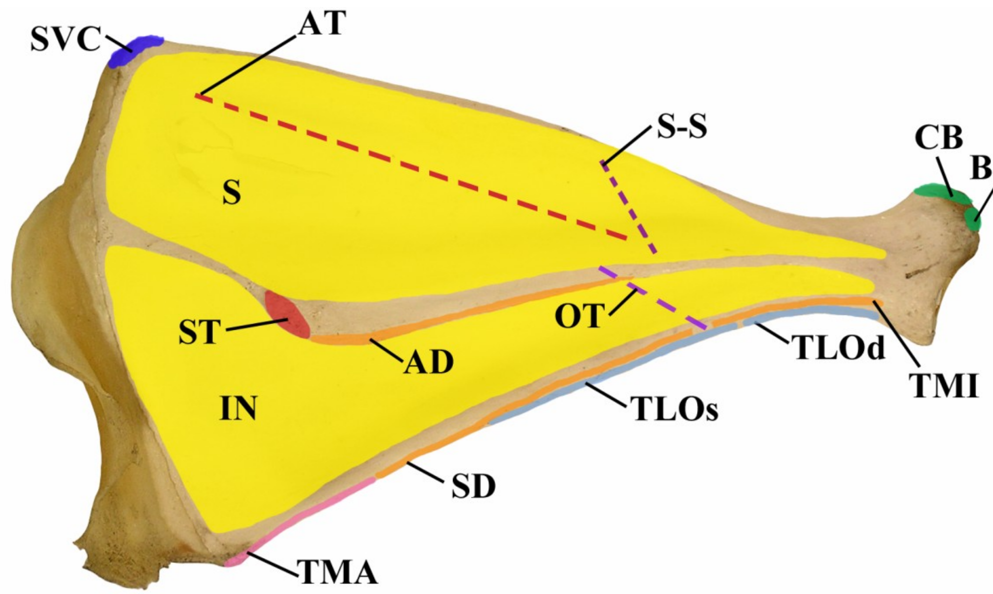
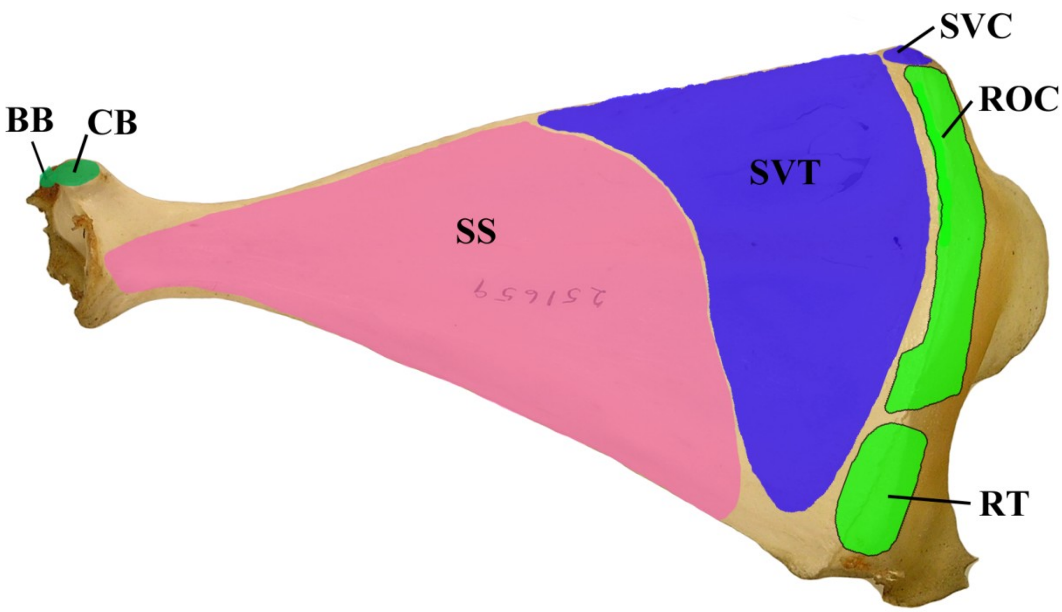


Figure 3.5A-21. Muscles of the manus. A. Tendons of mm. palmaris longus and flexor digitorum superficialis (P8280002). B. Tendons of m. flexor digitorum profundus (P8280003) C. Mm. contrahentes and flexor digitorum breves profundus (P8280025)

[C- contrahentes, FDS- flexor digitorum superficialis, FDP- flexor digitorum profundus, I- flexor digitorum breves profundus, PL- palmaris longus, u- ulnar nerve]



A.



B.

Figure 3.5A-22. Muscle attachment maps for the scapula.
A. Superficial surface of scapula. B. Deep surface of scapula.

[AD – acromiodeltoideus, AT – acromiotrapezius, BB – biceps brachii, CB – coracobrachialis, IN – infraspinatus, OT – omotransversarius, ROC – rhomboideus capitis et cervicis, RT – rhomboideus thoracis, S – supraspinatus, S-S- sternoscapularis, SD – spinodeltoideus, SS – subscapularis, ST – spinotrapezius, SVC – serratus ventralis cervicis, SVT – serratus ventralis thoracis, TLOd – triceps brachii caput longum profundus, TLOs - triceps brachii caput longum superficialis, TMA – teres major, TMI – teres minor]

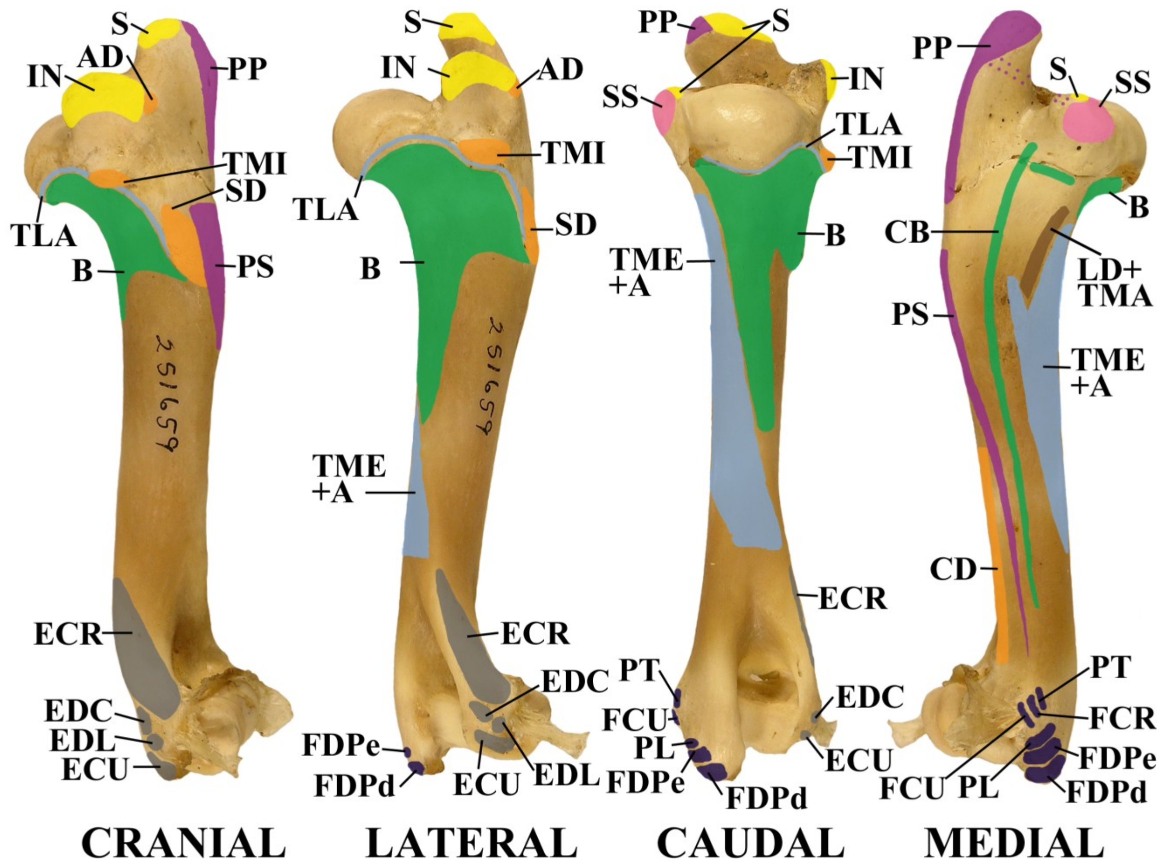


Figure 3.5A-23. Muscle attachment maps for the humerus.

[A- anconeus, AD- acromiodeltoideus, B- brachialis, CB- coracobrachialis, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, FDPe- superficial portion of flexor digitorum profundus, FDPd- deep portion of flexor digitorum profundus, IN- infraspinatus, LD- latissimus dorsi, PL- palmaris longus, PP- pectoralis profundus, PS – pectoralis superficialis, PT- pronator teres, S- supraspinatus, SD- spinodeltoideus, SS- subscapularis, TLA- triceps brachii caput laterale, TMA- teres major, TME- triceps brachii caput mediale, TMI- teres minor]

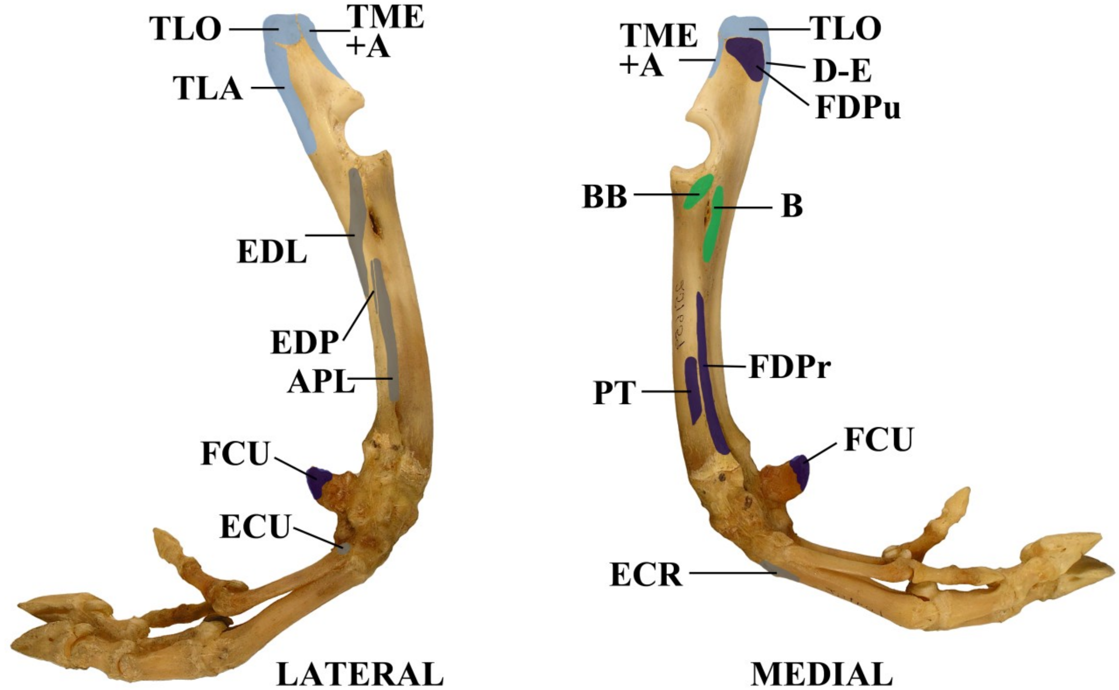


Figure 3.5A-24. Muscle attachment maps for the radius, ulna, and manus.

[A – anconeus, APL – abductor pollicis longus, B – brachialis, BB – biceps brachii, D-E – dorso-epitrochlearis, ECR – extensor carpi radialis, ECU – extensor carpi ulnaris, EDP – extensor digitorum profundus, FCU – flexor carpi ulnaris, FDPr – radial head of flexor digitorum profundus, FDPu – ulnar head of flexor digitorum profundus, PT – pronator teres, TLA – triceps brachii caput laterale, TLO – triceps brachii caput longum TME – triceps brachii caput mediale]

3.5B – Artiodactyla – Tragulidae – *Tragulus napu*

A description is given of the extrinsic and intrinsic muscles of the forelimb of a female specimen of *Tragulus napu*, the Greater Mouse-Deer (Artiodactyla: Tragulidae). The animal died at the National Zoological Park in 1932. A former student in the Department of Art as Applied to Medicine at Johns Hopkins School of Medicine, Ophelia Lee, began dissection of the forearm of this specimen. She made little progress, but I was not able to observe all muscles in situ. All descriptions and photographs are my own.

The condition of the specimen was excellent externally. However, as the specimen has been preserved in ethanol for 80 years, it is quite dry. There was also an abundance of white granules throughout the tissue, which made skinning and cleaning the specimen especially difficult. These granules are presumably calcium-derived, as the bones of the specimen are soft and bendable.

Figure 3.5B-1. Pre-dissection photograph of *Tragulus napu*, NMNH 258348, lateral view.

0. CUTANEOUS MUSCULATURE

mm. sphincter colli, panniculus carnosus, cutaneous ventralis, dorsocutaneous

M. sphincter colli is not robust, and consists only of a few circumferential fibers tightly attached to the skin of the neck.

M. panniculus carnosus originates from the dorsal midline and the lateral and ventral thorax and abdomen. Caudally it terminates over the thigh, and cranially it is fused with mm. latissimus dorsi and pectoralis abdominalis near the caudal axilla.

M. cutaneous ventralis is visible along the surface of m. panniculus carnosus as paired sagittal strips of muscle.

There is no m. dorsocutaneous.

Figure 3.5B-2. M. panniculus carnosus [PC], lateral view (P1170010).

A. TRAPEZIUS GROUP – ACCESSORY NERVE and CERVICAL NERVES

mm. sternomastoideus, cleidomastoideus, clavotrapezius, acromiotrapezius, spinotrapezius

M. sternomastoideus originates from the paroccipital process and from the fascia over m. masseter and descends ventrally to join with its partner in the neck. Thus it is a powerful band of tissue in the ventral neck. It has a lengthy insertion along the sternum deep to the origin of m. pectoralis superficialis.

M. cleidomastoideus originates from the paroccipital process deep to m. sternomastoideus. It ends at the clavicular intersection, the remnant of the clavicle. There it joins with the deep surface of m. clavotrapezius and the origin of m. clavodeltoideus to form "m. brachiocephalicus," which goes on to insert on the forearm.

M. clavotrapezius originates from the occipital crest cranial and superficial to m. acromiotrapezius. It covers much more of m. omotransversarius than does m. clavotrapezius in *Pecari*. It ends at the clavicular intersection, where it joins with mm. clavodeltoideus and cleidomastoideus to form "m. brachiocephalicus." Between mm. clavotrapezius and acromiotrapezius is a mass of fatty tissue that contains the great auricular nerve.

M. acromiotrapezius originates on the occiput deep to m. clavotrapezius and from the ligamentum nuchae and first two thoracic spinous processes. At the scapula, its cranial edge is slightly merged with m. omotransversarius, so that the two muscles become one broad 5.5-cm sheet attaching along the spine of the scapula and curving caudally onto the surface of mm. deltoideus. The accessory nerve enters the underside of m. acromiotrapezius from just lateral to m. sternomastoideus.

M. spinotrapezius is a fan-shaped muscle with a broad, rounded origin from the third to thirteenth thoracic vertebrae, overlapping m. latissimus dorsi by 4 cm. A few muscle fibers mix in the fascia between the cranial edge of m. spinotrapezius and the caudal edge of m. acromiotrapezius over the vertebral border of the scapula, but along the dorsum of the animal the two portions of trapezius have a distinct gap between them. M. spinotrapezius narrows to a blunt U-shaped insertion on the posterior spine of the scapula, just beyond the insertion of m. acromiotrapezius.

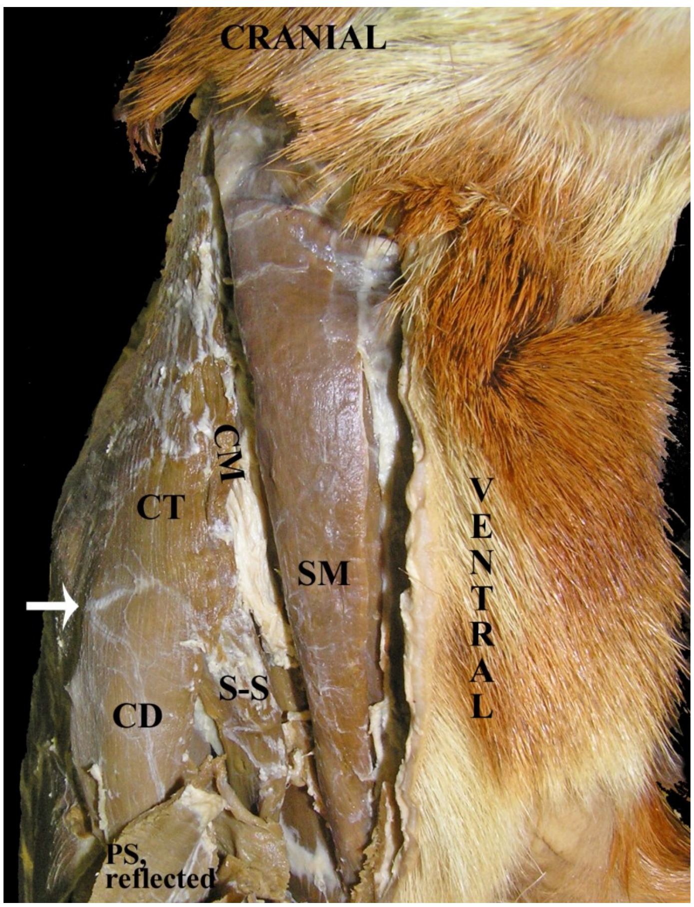
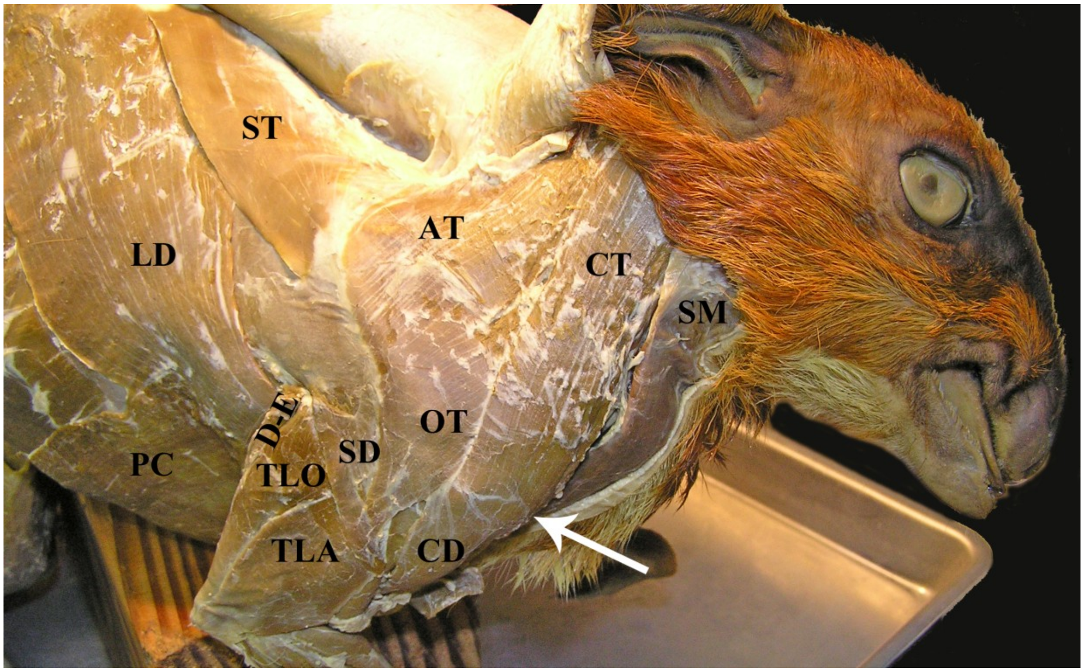
A. 

Figure 3.5B-3. Trapezius complex.

A. Ventral view (P6300027). White arrow marks clavicular intersection.

[CD- clavodeltoideus, CM- cleidomastoideus, CT- clavotrapezius, PS- pectoralis superficialis reflected from origin, S-S- sternoscapularis, SM- sternomastoideus]

B. 

C. 

Figure 3.5B-3 continued. Trapezius complex. B. Lateral view (P7170058). C. Dorsal view (P7180066). White arrow marks clavicular intersection.

[AT- acromiotrapezius, CD- clavodeltoideus, CM- cleidomastoideus, CT- clavotrapezius, D-E- dorso-epitrochlearis, LD- latissimus dorsi, OT- omotransversarius, PC- panniculus carnosus, PS- pectoralis superficialis reflected from origin, S-S- sternoscapularis, SD- spinodeltoideus, SM- sternomastoideus, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum]

B. RHOMBOID GROUP – DORSAL SCAPULAR NERVE

mm. rhomboideus capitis et cervicis, rhomboideus thoracis

Mm. rhomboideus capitis et cervicis is completely covered by the trapezius complex. It is made up of one larger and fairly robust strip of muscle from the occiput, m. rhomboideus capitis, and four thinner and more vertical fasiculi spanning 4 cm along the cervical spine, m. rhomboideus cervicis. This results in an insertion via digitations covering 2 cm of the cartilaginous portion of the scapula, beginning just distal to the cranial angle and extending along half of the deep surface of the vertebral border.

M. rhomboideus thoracis is also completely covered by the trapezius complex. This portion of mm. rhomboideus is thin and square and originates for 3 cm along the proximal three thoracic vertebrae. It inserts in a triangular shape on the deep surface of the cartilage along the distal half of the vertebral border of the scapula.

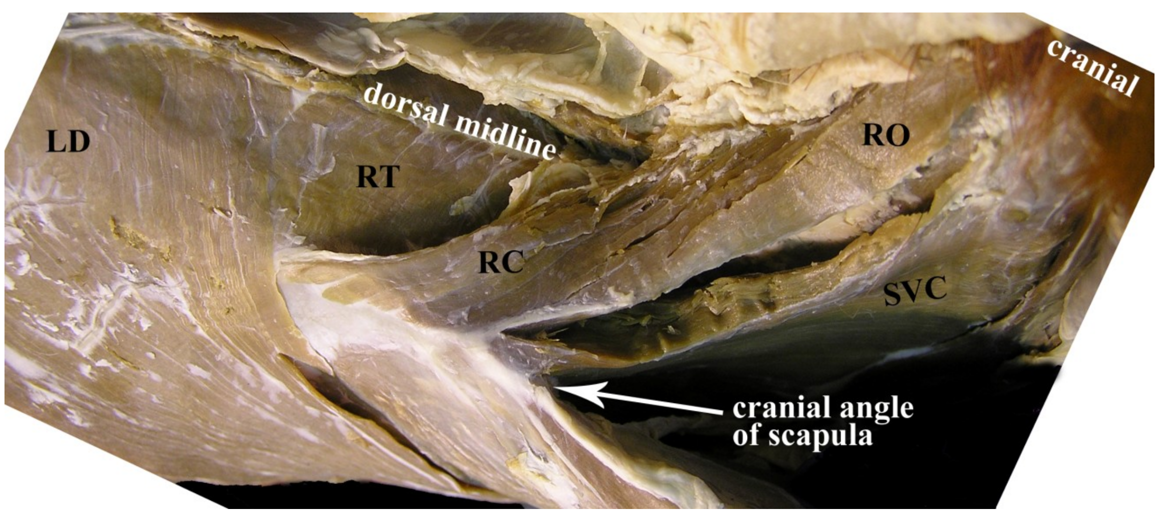


Figure 3.5B-4. Mm. rhomboideus, dorso-lateral view (P7180090).

[LD- latissimus dorsi, RC- rhomboideus cervicis, RO- rhomboideus capitis, RT- rhomboideus thoracis, SVC- serratus ventralis cervicis]

C. OMO GROUP – CERVICAL NERVES, LONG THORACIC NERVE

mm. omotransversarius, omohyoideus, serratus ventralis (cervicis, thoracis)

M. omotransversarius originates from the transverse process of the atlas, and travels deep to m. clavotrapezius. It emerges very closely applied to and even partially fused with the cranial edge of m. acromiotrapezius, as a broad 5.5-cm sheet covering and inserting on the cranial half of the superficial surface of the scapula. The insertion of omotransversarius curves over mm. deltoideus.

M. omohyoideus originates from the hyoid and crosses over the middle of m. sternoscapularis to insert on the fascia over m. supraspinatus near the acromion.

M. serratus ventralis cervicis originates from all the cervical vertebrae. It emerges from deep to mm. scalenus and is completely covered by the trapezius complex. M. serratus ventralis cervicis is three times thicker than m. serratus ventralis thoracis. It inserts on the cranial border of the scapula near the junction of bone and cartilage.

M. serratus ventralis thoracis originates from the proximal nine ribs via clear digitations. It sweeps along the thorax and, fusing with m. serratus ventralis cervicis, inserts in a triangular shape on the cranial half of the subscapular fossa, between the attachments of mm. rhomboideus and subscapularis. Together, mm. serratus ventralis cervicis et thoracis is a large sheet of muscle spanning 20 cm along the neck and thorax. The muscles act to powerfully rotate and protract the scapula, crucial for effective cursorial locomotion.

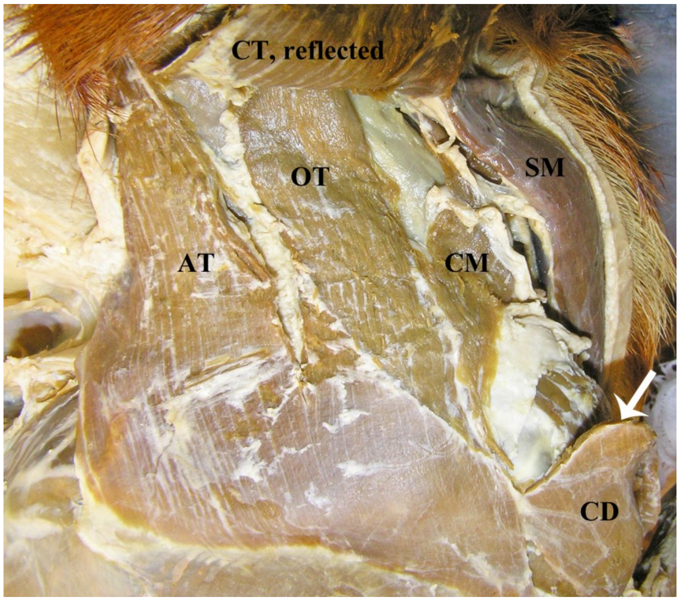


Figure 3.5B-5. M. omotransversarius, lateral view. M. clavotrapezius reflected from the clavicular intersection, marked by white arrow (P7180071).

[AT- acromiotrapezius, CD- clavodeltoideus, CM- cleidomastoideus, CT- clavotrapezius, OT- omotransversarius, SM- sternomastoideus]

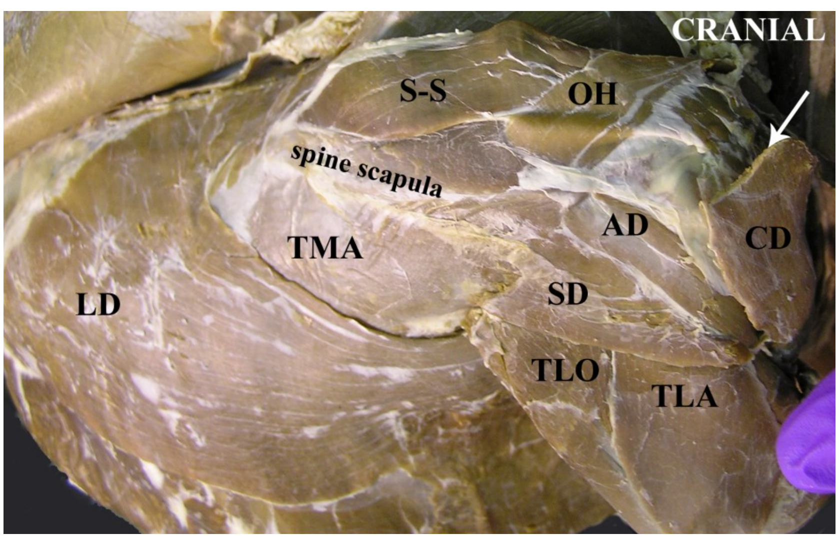
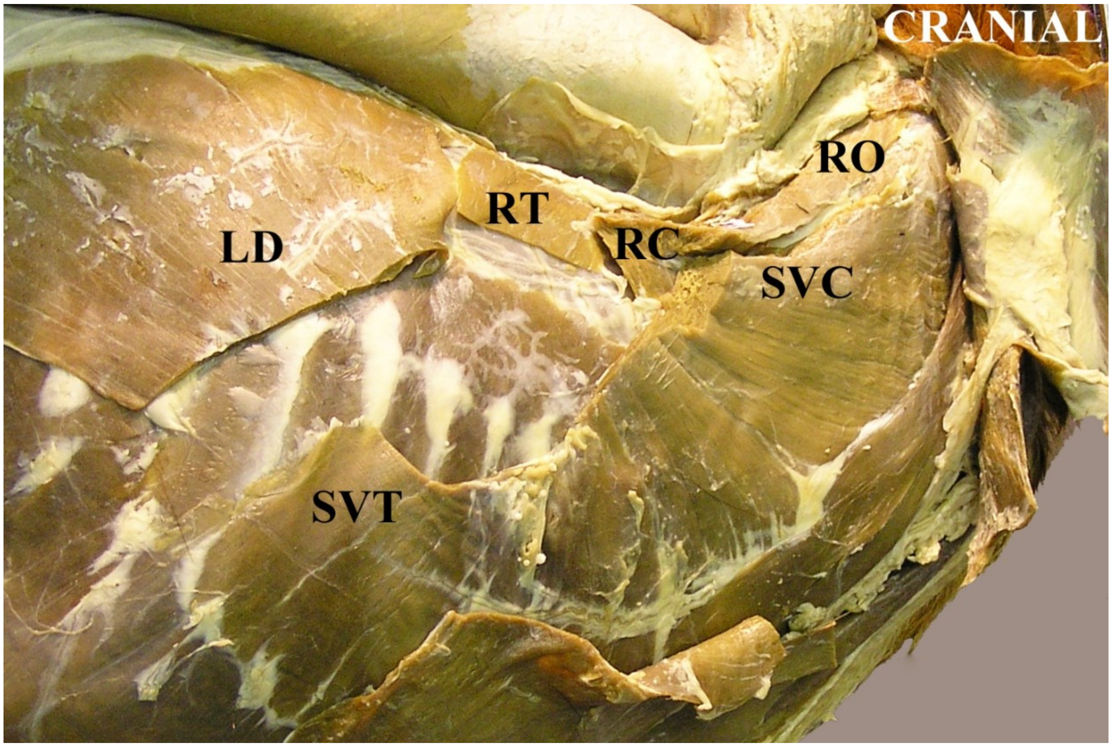
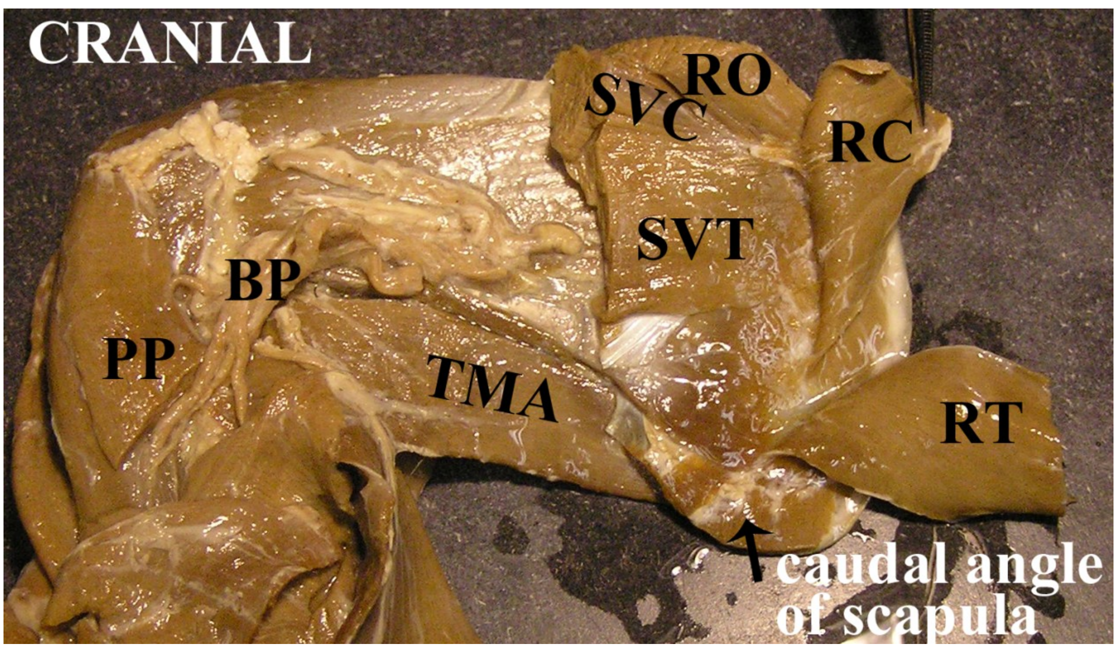


Figure 3.5B-6. Insertions of mm. omohyoideus and sternoscapularis, lateral view (P7180085). Location of clavicular intersection marked by white arrow.

[AD- acromiodeltoideus, CD- clavodeltoideus, LD- latissimus dorsi, OH- omohyoideus, S-S- sternoscapularis, SD- spinodeltoideus, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, TMA- teres major]



A.



B.

Figure 3.5B-7. Mm. serratus ventralis A. Origins from neck and thorax after forelimb removed, lateral view (P7240027). B. Insertions on deep surface of scapula (P7020431).

[bp- brachial plexus, LD- latissimus dorsi, PP- pectoralis profundus, RC- rhomboideus cervicis, RO- rhomboideus capitis, RT- rhomboideus thoracis, SVC- serratus ventralis cervicis, SVT- serratus ventralis thoracis, TMA- teres major]

D. DELTOID GROUP – AXILLARY NERVE

mm. clavodeltoideus, acromiodeltoideus, spinodeltoideus, teres minor

M. clavodeltoideus originates at the clavicular intersection, where it is fused with m. clavotrapezius. It joins with the conjoined mm. acromio- et spinodeltoideus at midshaft of the humerus, and then continues to insert via fleshy fibers for 1.5 cm along the cranial surface of the distal humerus. It also has a connection with m. pectoralis superficialis, and the cephalic vein emerges between the two muscles. The axillary nerve emerges from between mm. clavodeltoideus and spinodeltoideus.

M. acromiodeltoideus is 9 mm wide where it originates from the acromion. One cm distal to the origin it fuses with m. spinodeltoideus.

M. spinodeltoideus originates for 1.5 cm from the acromial end of the scapular spine and for 1 cm of fascia over m. infraspinatus. It fuses with the edge of m. acromiodeltoideus. The conjoined mm. acromio- et spinodeltoideus inserts for 1.5 cm on the cranial surface of the humerus, from the distal end of the greater tuberosity to about midshaft. At midshaft, m. clavodeltoideus joins them also, but continues with its own insertion along the distal surface of the humerus.

M. teres minor is completely hidden by m. infraspinatus, though it originates fairly broadly from the lateral half of the caudal border and neck of the scapula. It narrows to a small tendon that inserts deep and slightly distal to the insertion of m. infraspinatus on the lateral aspect of the greater tuberosity.

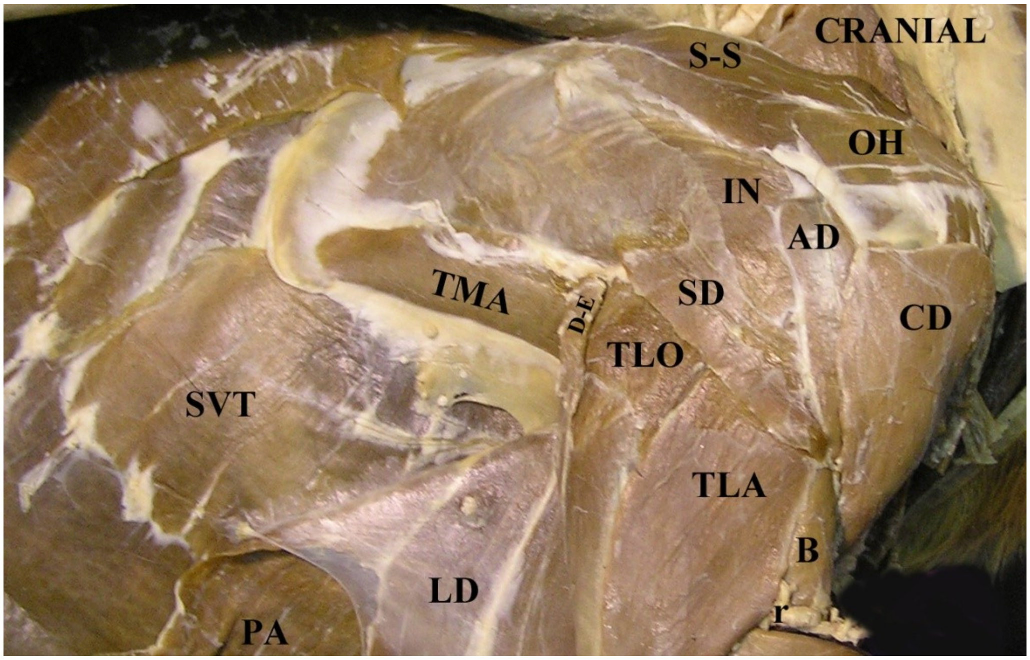


Figure 3.5B-8. Mm. deltoideus, lateral view of shoulder (P7230009).

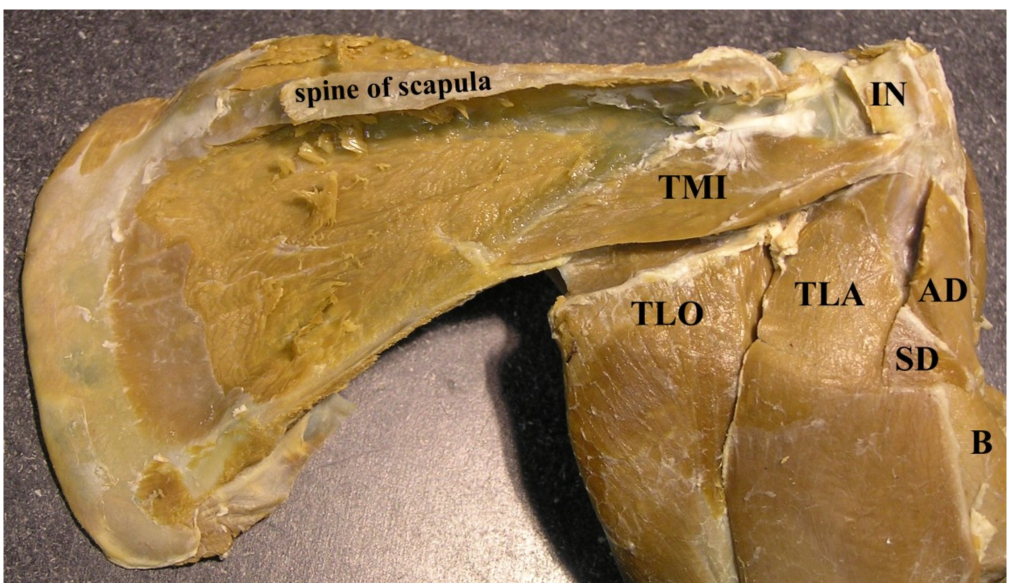


Figure 3.5B-9. M. teres minor, lateral view (P8280068).

[AD- acromiodeltoideus, B- brachialis, CD- clavodeltoideus, D-E- dorso-epitrochlearis, IN- infraspinatus, LD- latissimus dorsi, r- radial nerve, OH- omohyoideus, PA- pectoralis abdominalis, S-S- sternoscapularis, SD- spinodeltoideus, SVT- serratus ventralis thoracis, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, TMA- teres major, TMI- teres minor]

E. SUBSCAPULARIS GROUP – SUBSCAPULAR NERVE

mm. subscapularis, teres major

M. subscapularis originates from the subscapular fossa and the edge of the supraspinatus, which curves over and above the scapula. There are accessory slips originating near teres major that fuse with the bulk of the muscle. It inserts via a strong tendon on the lesser tuberosity.

M. teres major originates for 3 cm along the junction between the bony and cartilaginous portions of the scapula. The bony origin is marked by a rugosity on the caudal border of the scapula near the caudal angle. M. teres major also originates robustly from the caudal edge of m. subscapularis. The muscle is 1 cm wide but widens to 1.5 cm prior to fusion with the cranial edge of m. latissimus dorsi. Their conjoined tendon travels deep to the brachial plexus and inserts on the medial side of the humerus deep to m. coracobrachalis.

F. LATISSIMUS GROUP – THORACODORSAL NERVE

m. latissimus dorsi

M. latissimus dorsi is extensive, originating from the thoracolumbar fascia and fifth thoracic to the proximal lumbar vertebrae. It lies deep to m. spinotrapezius and even reaches the origin of m. rhomboideus thoracis. In addition to its fusion with m. teres major, m. latissimus dorsi fuses with part of m. panniculus carnosus before insertion.

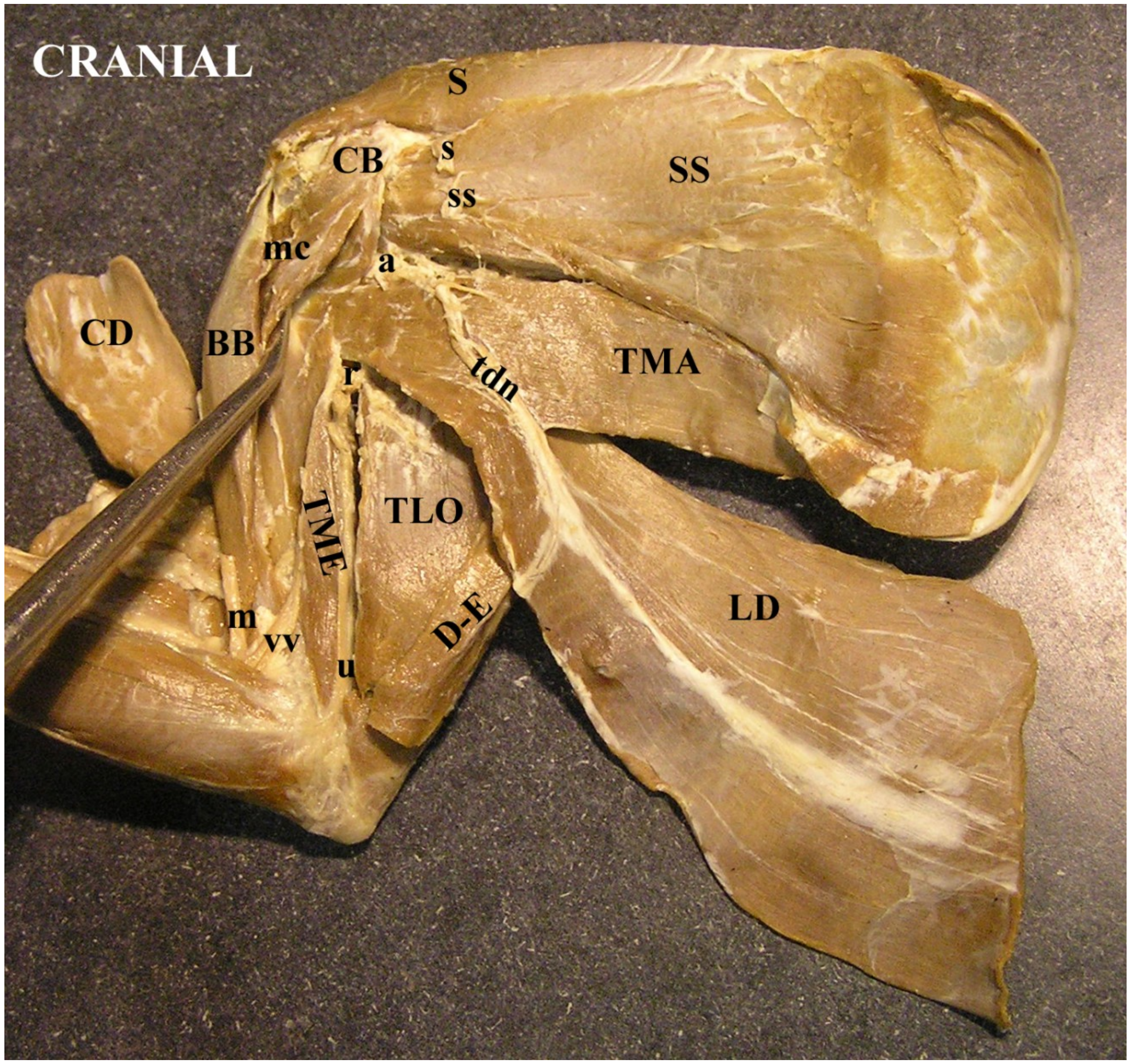


Figure 3.5B-10. Mm. teres major and subscapularis, deep surface of scapula (P8134571).

[a- axillary nerve, BB- biceps brachii, CB- coracobrachialis, CD- clavodeltoideus, D-E- dorso-epitrochlearis, LD- latissimus dorsi, m- median nerve, mc- musculocutaneous nerve, tdn- thoracodorsal nerve, TLO- triceps brachii caput longum, TMA- teres major, TME- triceps brachii caput mediale, s- suprascapular nerve, S- supraspinatus, ss- subscapular nerve, SS- subscapularis, vv- vessel]

G. PECTORALS and SUBCLAVIUS GROUP – PECTORAL NERVES

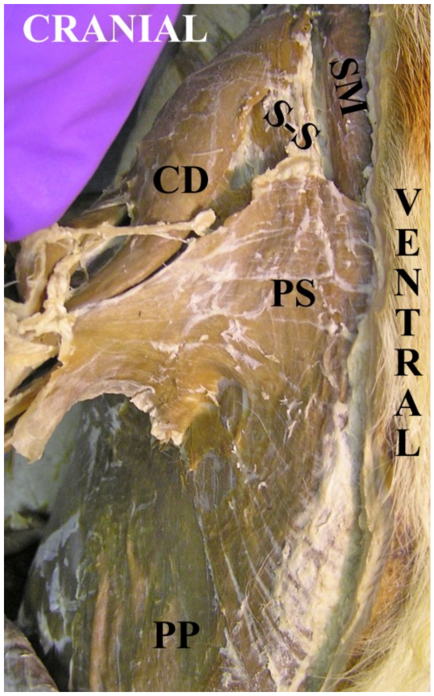
mm. pectoralis superficialis, pectoralis profundus, pectoralis abdominalis, subclavius, sternoscapularis

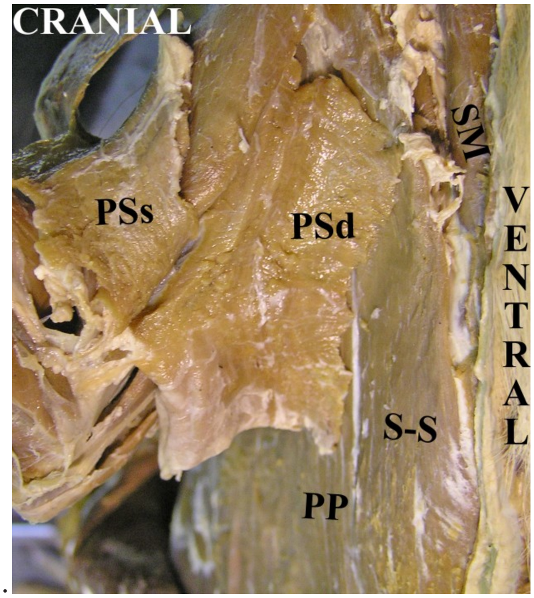
M. pectoralis superficialis consists of two thin sheets of muscle extending for 9 cm from the manubrium down to the mid-thorax, covered at its origin by a large and fatty fibrous pad. It is fused distally and on its deep surface with mm. pectoralis profundus et abdominalis. The superficial portion of pectoralis superficialis narrows to a 1-cm fleshy insertion on the distal quarter of the cranial surface of the humerus, just medial to the insertion of m. clavodeltoideus. It also has a fascial expansion onto the entire medial surface of the distal third of the arm and the entire forearm. The deep portion of m. pectoralis superficialis inserts just medial to the insertion of the superficial portion.

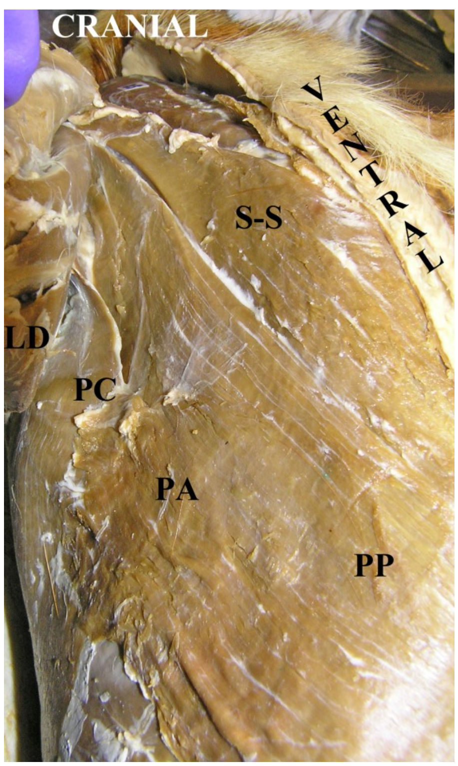
M. pectoralis profundus and m. pectoralis abdominalis are fused, and the conjoined muscle has a 7.5-cm origin along the xiphisternum, thorax, and abdomen. The muscle is rectangular, then narrows and inserts broadly over the cranial surface of the greater tuberosity. It has a connection with m. panniculus carnosus in the axilla, just at the caudal border of m. latissimus dorsi.

M. sternoscapularis originates for 4 cm along the distal half of the sternum, then sweeps dorsally to form a robust cap over the cranial edge of the scapula. It inserts via fleshy fibers on the fascia covering m. supraspinatus which extends for more than half the length of the scapula.

M. subclavius is absent.

A. 

B. 

C. 

CD- clavodeltoideus

LD- latissimus dorsi

PA- pectoralis abdominalis

PC- panniculus carnosus

PP- pectoralis profundus

PS- pectoralis superficialis

PSd- deep portion pectoralis superficialis

PSs- superficial portion pectoralis superficialis

S-S- sternoscapularis

SM- sternomastoideus

Figure 3.5B-11. Mm. pectoralis, ventral view.

A. Superficial portion of m. pectoralis superficialis (P6300010). B. Deep portion of m. pectoralis superficialis (P6300020). C. Mm. pectoralis profundus et abdominalis and m. sternoscapularis (P6300024).

H. BICEPS GROUP – MUSCULOCUTANEOUS NERVE

mm. coracobrachialis medius et profundus, biceps brachii, brachialis

M. coracobrachialis is made up of two portions: the more robust m. coracobrachialis medius, which originates from the coracoid process, and the thinner and more distal m. coracobrachialis profundus, which takes origin from the center of the origin of coracobrachialis medius. The two parts have slightly different fiber directions and overlapping insertions on the cranio-medial humerus; both insertions are 1.1 cm wide, but the insertion of m. coracobrachialis medius is fleshy and the insertion of m. coracobrachialis profundus is via thin tendinous fibers.

M. biceps brachii is a single belly. It originates from the supraglenoid tubercle by a flattened tendon, and travels deep to a robust transverse humeral ligament which spans from the large fossa on the lesser tuberosity to the medial edge of the greater tuberosity. The muscle becomes fleshy immediately after emerging from deep to the ligament and remains fleshy almost to insertion. It forms a strong tendon that inserts in a broad arc across the cranial and medial sides of the radial neck.

M. brachialis originates from below the greater tuberosity to the caudo-lateral neck of the humerus where it abuts the origin of m. triceps brachii caput mediale. The muscle is robust and fleshy as it curves around the humerus to end at the medial side of the elbow. It inserts via a flat 3 mm-wide tendon on the medial aspect of the proximal ulna, superficial to the insertion of m. biceps brachii. I could not determine the innervation, but median nerve innervation has been reported for many other artiodactyls (Windle & Parsons, 1901; Campbell, 1936).

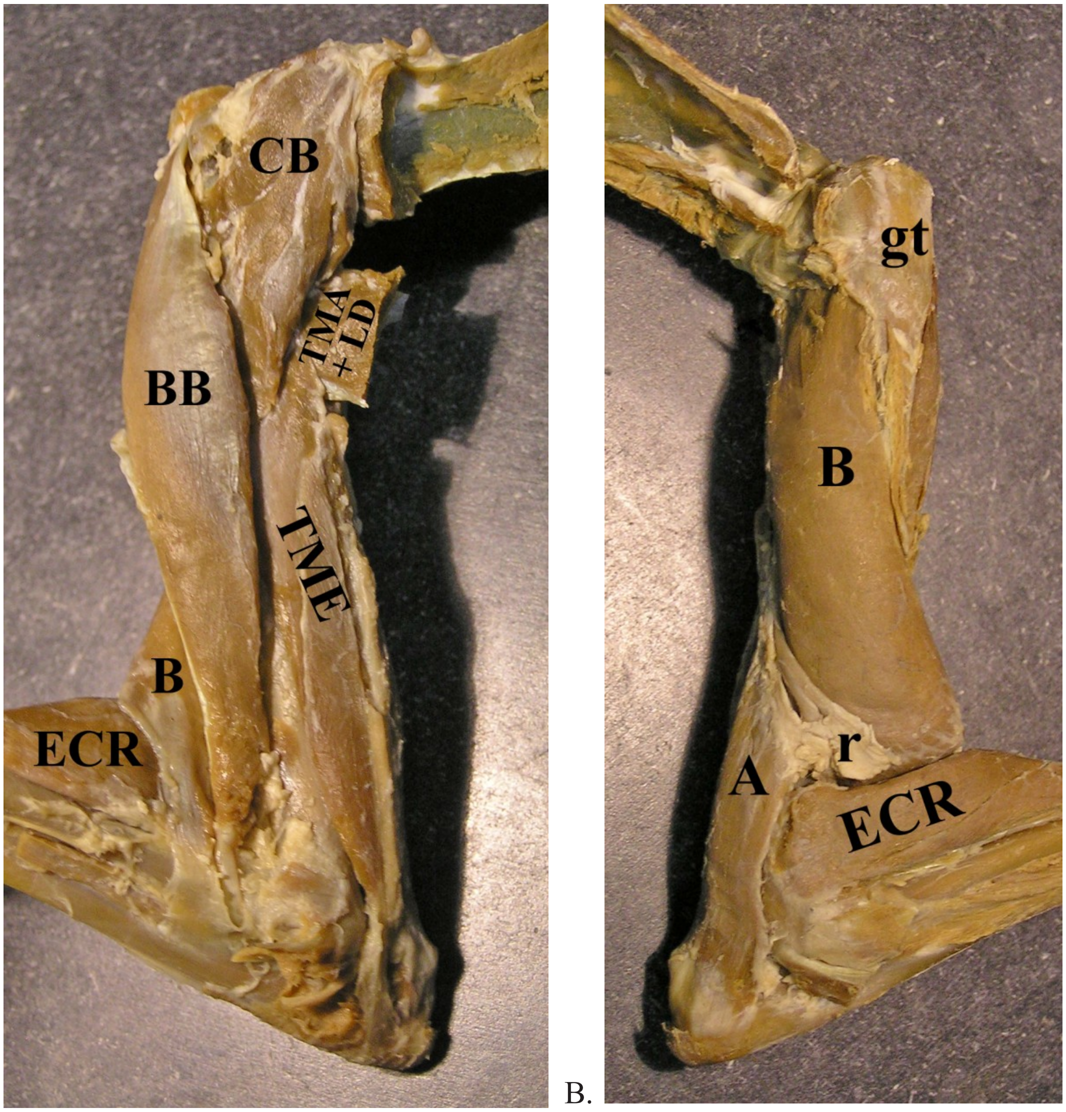
A.  B.

Figure 3.5B-12. Muscles of the biceps group.
A. Deep medial view (PA090209). B. Lateral view (PA090234).

[A- anconeus, B- brachialis, BB- biceps brachii, CB- coracobrachialis, ECR- extensor carpi radialis, gt- greater tuberosity, r- radial nerve, TMA+LD- conjoined teres major and latissimus dorsi, TME- triceps brachii caput mediale]

I. SPINATI GROUP – SUPRASCAPULAR NERVE

mm. supraspinatus, infraspinatus

M. supraspinatus is robust and originates from the cranial surface of the scapular spine and acromion, the supraspinous fossa, and the cranial border of the scapula. It has an extensive insertion on the cranial and lateral surfaces of the greater tuberosity.

M. infraspinatus is broader but thinner than m. supraspinatus. It originates from the caudal border of the scapular spine, the deep surface of the acromion, and the infraspinous fossa. The muscle fibers converge to a tendon which inserts on the base of the greater tuberosity.

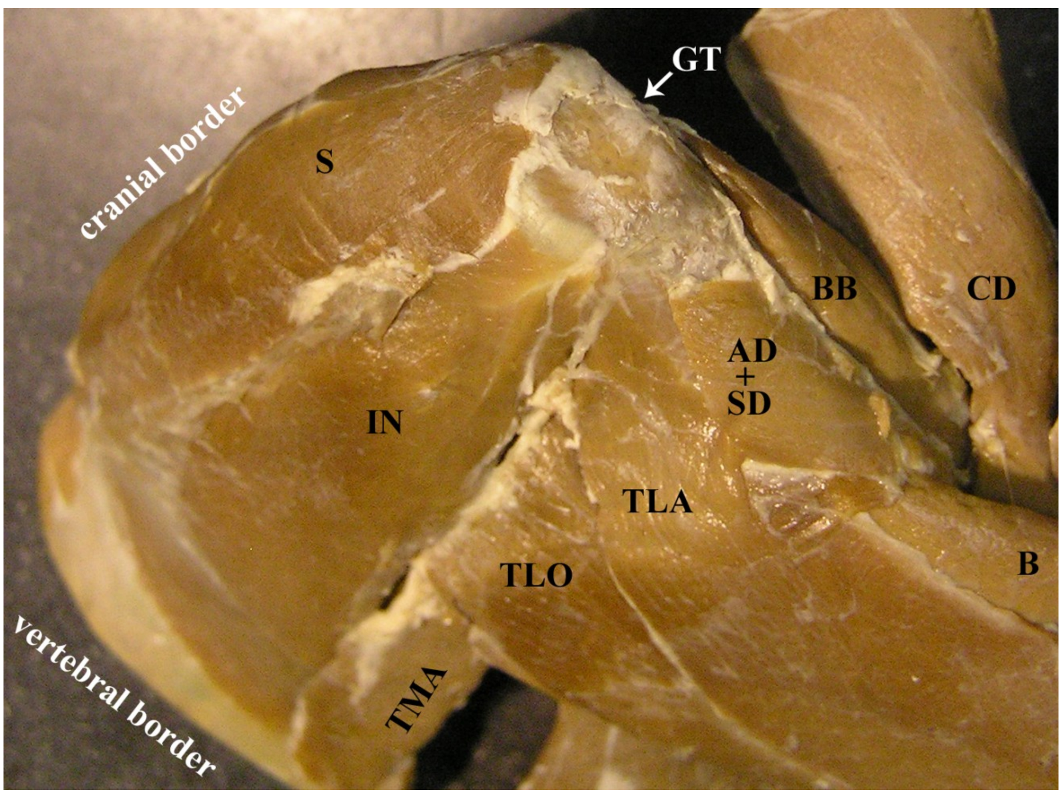


Figure 3.5B-13. Mm. supraspinatus and infraspinatus, cranio-lateral view (P8134579).

[AD+SD- acromio- et spinodeltoideus, B- brachialis, BB- biceps brachii, CD- clavodeltoideus, IN- infraspinatus, S- supraspinatus, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, TMA- teres major]

J. TRICEPS GROUP – RADIAL NERVE

mm. dorso-epitrochlearis, triceps brachii (caput laterale, caput mediale, caput longum), anconeus

M. dorso-epitrochlearis takes origin from m. teres major, just before m. teres major fuses with m. latissimus dorsi. M. dorso-epitrochlearis has no connection with m. latissimus dorsi. It inserts on the medial side of the olecranon, superficial to the insertion of mm. triceps brachii. A neurovascular bundle travels from the deep surface of m. subscapularis down through the groove between the partially divided heads of m. triceps brachii caput longum, and enters the deep surface of m. dorso-epitrochlearis.

M. triceps brachii caput longum is partially separated into superficial and deep portions. M. triceps brachii caput longum superficialis originates via fleshy fibers for 1.5 cm along the caudal margin of the neck of the scapula. M. triceps brachii caput longum profundus originates via a shiny 1 cm-wide tendon from the same part of the scapula. The two parts are separable only on their lateral edge proximally for 1 cm; the medial edge is completely fused. The muscle inserts via a thickened tendon on the medial and lateral edges of the tip of the olecranon.

M. triceps brachii caput laterale is a broad muscle which originates for 1.5 cm along the proximal caudo-lateral aspect of the humerus. Its origin is just distal to the greater tuberosity and the insertion of m. teres minor, and just lateral to the insertion of m. spinodeltoideus. It inserts for 7 mm along the lateral and caudal surfaces of the olecranon, mostly separate from the insertion of m. triceps brachii caput longum.

M. triceps brachii caput mediale originates in two pieces that are split by the joint insertion of mm. latissimus dorsi and teres major. The medial piece originates for 2.5 cm along the medial side of the humerus, deep to the insertion of mm. coracobrachialis and superficial to the insertion of mm. latissimus dorsi and teres major. The lateral piece originates from inferior to the head of the humerus medial to the origin of brachialis. The parts fuse and are also connected with m. anconeus, and they insert via fleshy fibers onto the cranial surface of the olecranon.

M. anconeus originates from the caudal surface of the humerus. Proximally it is free from m. triceps brachii caput mediale, but after a few mm they are fully fused. It inserts on the cranial surface of the olecranon.

A. B.

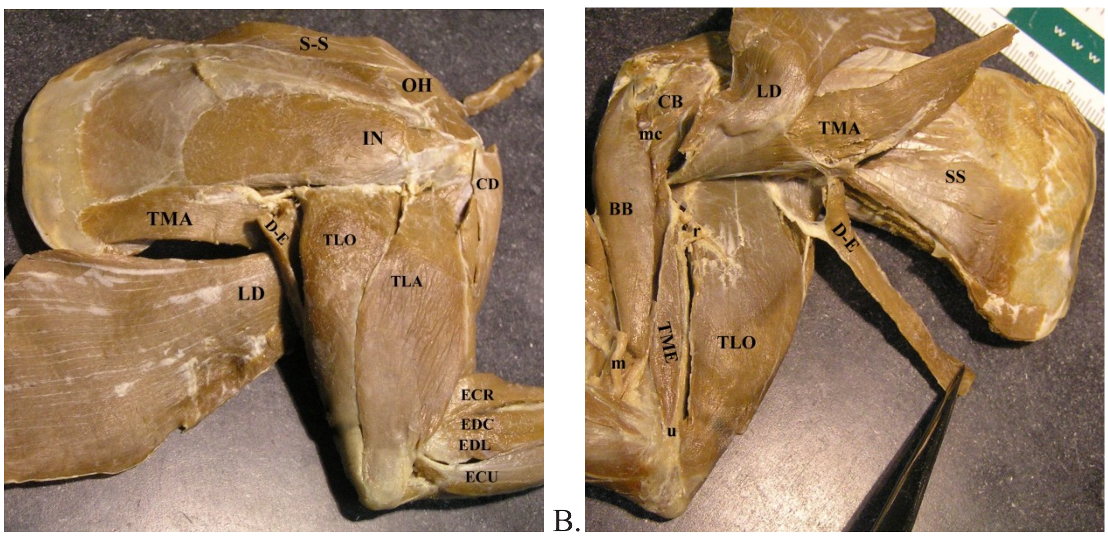


Figure 3.5B-14. M. dorso-epitrochlearis. A. Lateral view (P8134527). B. Medial view (P8134599).

[BB- biceps brachii, CB- coracobrachialis, CD- clavodeltoideus, D-E- dorso-epitrochlearis, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, IN- infraspinatus, LD- latissimus dorsi, m- median nerve, mc- musculocutaneous nerve, OH- omohyoideus, r- radial nerve, S-S- sternoscapularis, SS- subscapularis, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, TMA- teres major, TME- triceps brachii caput mediale, u- ulnar nerve]

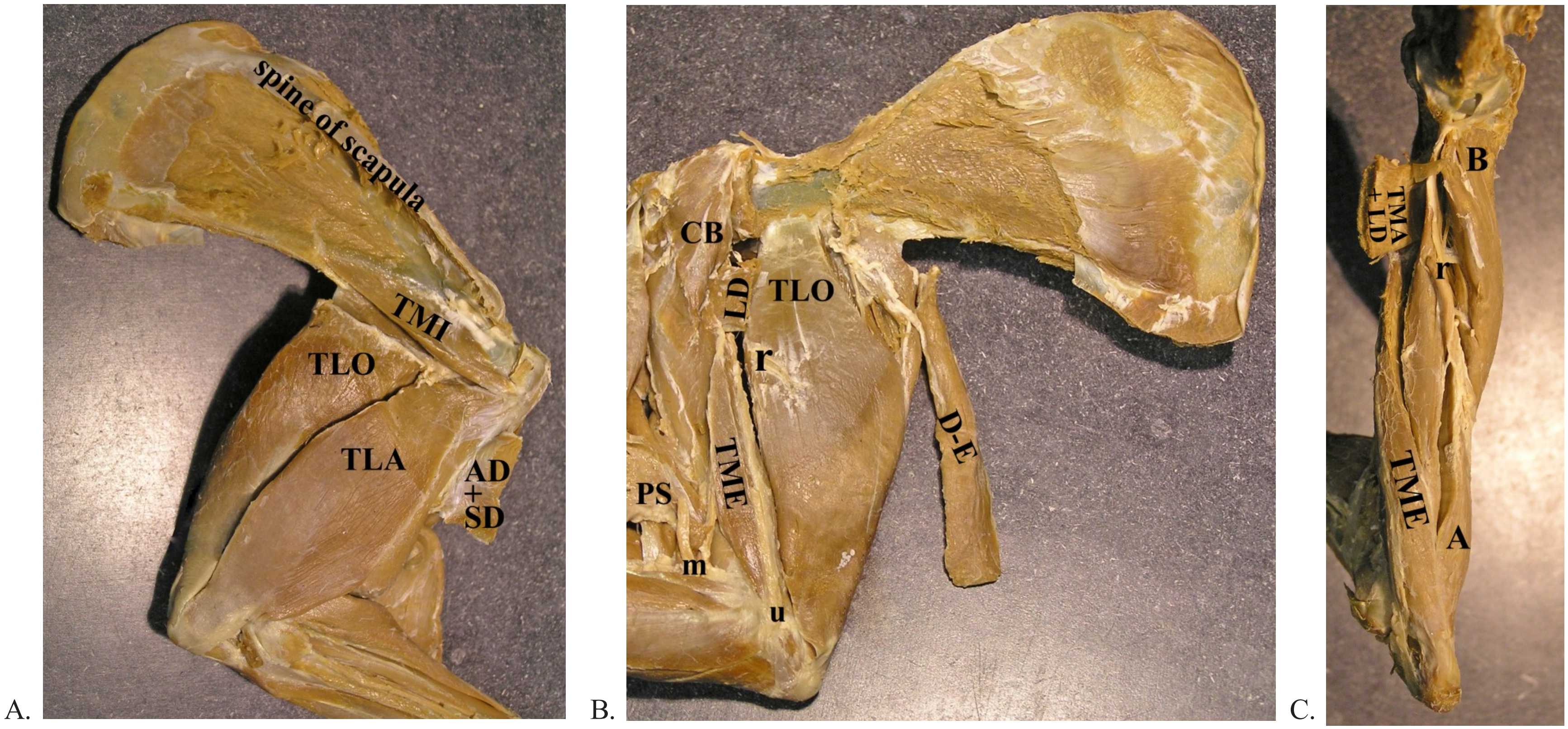


Figure 3.5B-15. Mm. triceps brachii. A. Lateral view (P8280071). B. Medial view (P8280078). C. Caudal view (PA090236).

[A- anconeus, AD+SD- acromio- et spinodeltoideus, CB- coracobrachialis, D-E- dorso-epitrochlearis, LD- latissimus dorsi, m- median nerve, PS- pectoralis superficialis, r- radial nerve, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum, TMA- teres major, TME- triceps brachii caput mediale, TMI- teres minor, u- ulnar nerve]

K. EXTENSOR GROUP – RADIAL NERVE

mm. brachioradialis, extensors carpi radialis longus et brevis, extensor digitorum communis, extensor digitorum lateralis, extensor carpi ulnaris, supinator, abductor pollicis longus, extensor digitorum profundus

M. brachioradialis is absent in *Tragulus*.

M. extensor carpi radialis longus and the deeper and more medial m. extensor carpi radialis brevis are mostly fused; the only evidence of the two bellies is a slight separation near their origin in lateral view. They originate for 8 mm on the lateral supracondylar ridge and epicondyle. The large fleshy belly narrows to a tendon that crosses deep to the tendon of m. abductor pollicis longus and inserts on a large tubercle on the cranio-medial edge of the base of metacarpal III.

M. extensor digitorum communis originates for 2 mm along the lateral epicondyle. It forms three small muscle bellies that are fleshy for 4 cm. Then they become tendons that pass deep to a retinaculum on the lateral side of the carpus. The most medial belly inserts along the center and medial side of digit III and sends a small tendon off to the lateral side of digit II. The middle belly inserts right down the center of the manus, ending as an expansion over the lateral side of digit III and the medial side of digit IV. The most lateral belly inserts on the medial side of digit V.

M. extensor digitorum lateralis originates for 6 mm from the distal margin of the lateral epicondyle and for 3.7 cm along the lateral surface of the shaft of the ulna. The muscle is fleshy for 4 cm, then its tendon travels through a groove on the lateral side of the forearm and deep to a retinaculum across the carpus. The tendon splits into three parts; one tendon inserts on the deep surface of the tendon of m. extensor digitorum communis for digit III, another tendon crosses deep to the tendon of m. extensor digitorum communis for digit V and inserts along the center of digit IV, and the third tendon inserts on the lateral side of digit V.

M. extensor carpi ulnaris originates via a tendon from the caudal surface of the lateral epicondyle. It expands to an 8 mm-wide belly which inserts on the lateral surface of the pisiform and the base of metacarpal V.

M. supinator is absent in *Tragulus.*

M. abductor pollicis longus originates for 2 cm along the groove between the fused radius and ulna, medial to m. extensor digitorum profundus. Its tiny tendon passes over the much larger tendon of m. extensor carpi radialis and passes deep to a tough retinaculum along the medial side of the carpus, from which it was very difficult to extract. It inserts on the medial side of the base of metacarpal II, about 3 mm medial to the insertion of m. extensor carpi radialis.

M. extensor digitorum profundus originates via fleshy fibers in a 3 cm-long strip along the lateral side of the ulna. It inserts via fleshy fibers into the middle tendon of m. extensor digitorum communis, which acts on digits III and IV.

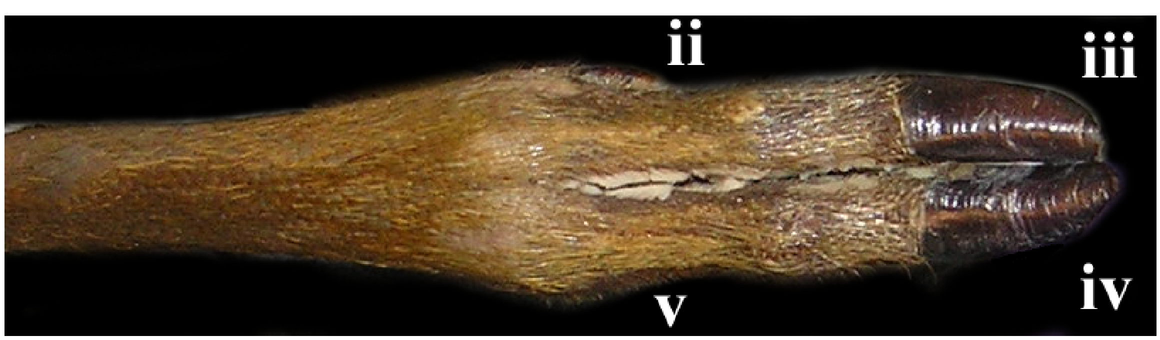


Figure 3.5B-16. Pre-dissection photograph of the right manus (P2282580).

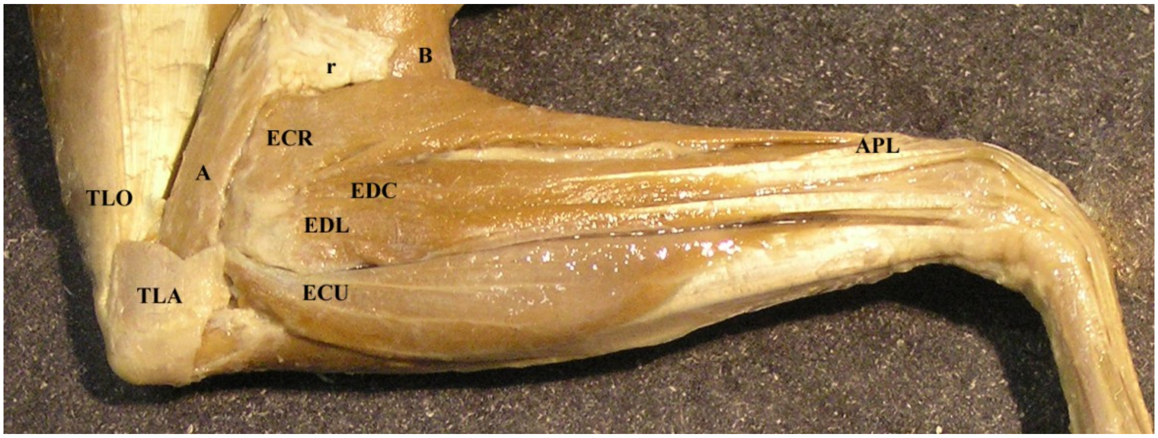


Figure 3.5B-17. Muscles originating from the lateral epicondyle (P8134517).

Figure 3.5B-18. M. extensor carpi radialis, cranial view (P8134532).

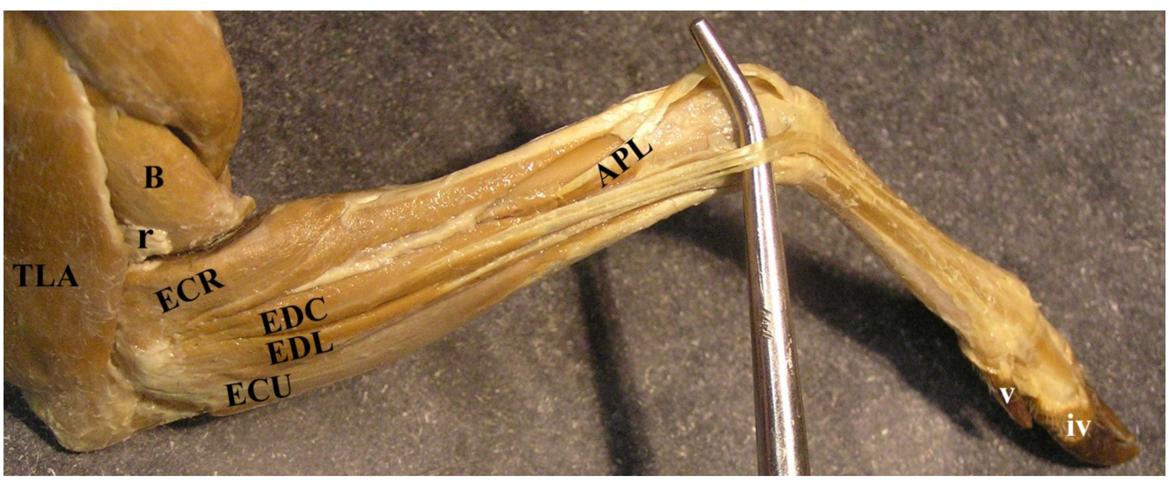


Figure 3.5B-19. M. extensor digitorum communis, lateral view (P8134533).

[A- anconeus, APL- abductor pollicis longus, B- brachialis, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, r- radial nerve, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum]

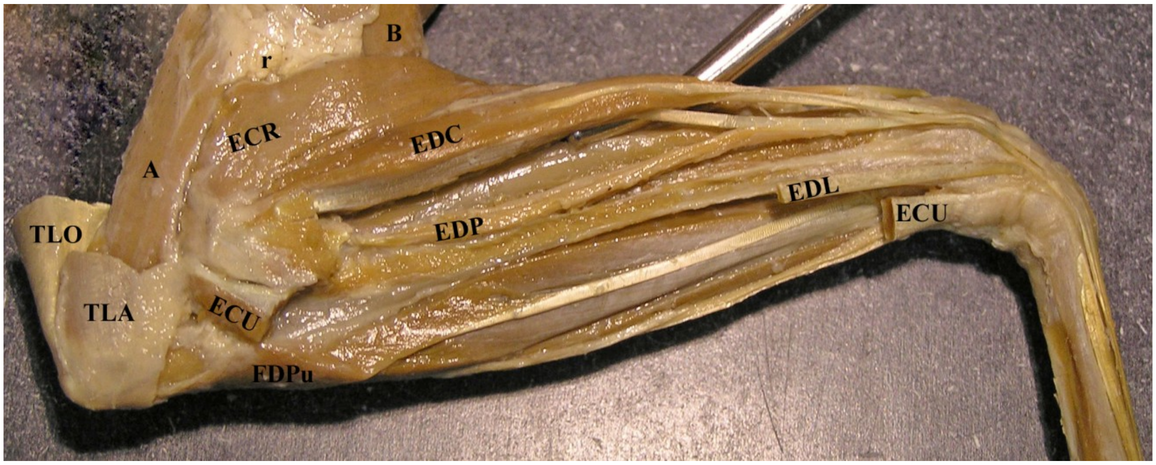


Figure 3.5B-20. M. extensor digitorum profundus, lateral view (P8280042).

A.

B.

Figure 3.5B-21. Extensor tendons of the manus. A. Dorsal view (P8134506) B. Lateral view (P8134513).

[A- anconeus, APL- abductor pollicis longus, B- brachialis, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, FDPu- ulnar head of flexor digitorum profundus, r- radial nerve, TLA- triceps brachii caput laterale, TLO- triceps brachii caput longum]

L. FLEXOR GROUP – MEDIAN and ULNAR NERVES

mm. pronator teres^{m}, flexor carpi radialis^{m}, palmaris longus^{u}, flexor digitorum superficialis, flexor digitorum profundus^{m+u}, flexor carpi ulnaris^{u}, epitrochleo-anconeus^{u}, pronator quadratus

M. pronator teres has the most proximal origin from the medial epicondyle. The muscle is largely tendinous, remaining fleshy for only 1.5 cm. Its tendon inserts along a ridge on the cranial aspect of the radius, adhering to the bone for the majority of the midshaft. It also is continuous with the long retinaculum around the tendon of m. flexor carpi radialis. The median nerve crosses deep to m. pronator teres to travel along the deep surface of m. flexor carpi radialis.

M. flexor carpi radialis originates from the medial epicondyle distal to the origin of m. pronator teres. It has a 3 cm-long fusiform, fleshy belly, which becomes a thin tendon that travels along the medial edge of the radius in a long retinaculum partially formed by the tendinous insertion of m. pronator teres. It inserts on the palmar surface of the base of metacarpal III.

M. flexor digitorum superficialis originates with m. palmaris longus as a thin, 3 mm-wide tendon from the medial epicondyle deep to the origin of m. flexor carpi ulnaris. The conjoined muscle does not become fully fleshy for 3 cm, at which point m. flexor digitorum superficialis takes origin from its deep surface as a small flat belly. This is fleshy for only 1 cm, then becomes tendinous to travel deep to the flexor retinaculum with the median nerve. It is perforated by the tendon of m. flexor digitorum profundus tendon for digit III.

It seems generally accepted that m. palmaris longus is absent in all artiodactyls but hippos (Fisher et al, 2007). However, the two-part m. flexor digitorum superficialis described by many authors for artiodactyls includes the muscle I interpret as m. palmaris longus because it does not pass deep to the flexor retinaculum. Indeed, compared with the situation in *Pecari*, mm. palmaris longus and flexor digitorum superficialis do appear to be a single muscle with two tendons in *Tragulus*. The conjoined muscle originates from the medial epicondyle. The tendon of m. palmaris longus travels deep to some tough fascia over the carpus and palm, and is perforated by the tendon of m. flexor digitorum profundus tendon for digit IV. It may be innervated by the branch of the ulnar nerve that pierces m. flexor carpi ulnaris.

M. pronator quadratus is absent in *Tragulus.*

M. flexor digitorum profundus has four heads of origin. The superficial epicondylar belly of m. flexor digitorum profundus has a large, U-shaped origin off the distal and caudal surfaces of the medial epicondyle of the humerus. The origin is deep to m. palmaris longus and is covered with a shiny tendon on which the muscle belly of m. palmaris longus glides. Otherwise the muscle remains fleshy to the carpus, and it forms the bulk of m. flexor digitorum profundus muscle. It is innervated by the median nerve. The deep epicondylar belly of m. flexor digitorum profundus originates via tendon from the medial epicondyle just proximal and deep to the origin of the superficial epicondylar belly. The 3 cm-long fleshy belly becomes a thin tendon that ends toward the medial edge of the conjoined flexor tendon. It is innervated by the median nerve. The radial belly of m. flexor digitorum profundus is a long flat muscle that originates from the medial side of the proximal radius. It has a tendon on its medial edge which fuses with the deep surface of the tendon of the superficial epicondylar belly of flexor digitorum profundus. It receives a branch of the median nerve. The ulnar belly of m. flexor digitorum profundus is a small triangular muscle originating from the medial aspect of the olecranon. The belly is fleshy for 2.5 cm and then becomes a long, slender tendon. The tendon ends toward the lateral edge of the conjoined tendon of m. flexor digitorum profundus. This portion of the muscle is innervated by the ulnar nerve.

At the carpus, the four portions of m. flexor digitorum profundus fuse to form a stout flexor tendon. The tendon splits over the metacarpals, to insert on only digits III and IV, while digits II and V receive no tendons in *Tragulus*. At the level of the middle phalanx, the tendon for digit IV perforates through the tendon of m. palmaris longus, and the tendon for digit III perforates through the tendon of m. flexor digitorum superficialis.

The median nerve runs with m. flexor digitorum superficialis, and at the metacarpophalangeal joint the nerve divides into two branches each of which splits again. One branch serves the lateral side of digit II and the medial side of digit III, and the other branch serves the lateral side of digit III and the medial side of digit IV.

The humeral and ulnar heads of m. flexor carpi ulnaris are completely fused into one. The bony origin of the fused muscle, representing the dominant humeral belly, is solely from 7 mm along the caudal margin of the medial epicondyle; but there are also some fleshy fibers taking origin from the tendinous remnant of m. epitrochleo-anconeus, representing the vestigial ulnar belly. The muscle is fleshy for 4 cm and then becomes a flat tendon that inserts on the pisiform.

M. epitrochleo-anconeus is represented by a tendinous band stretching between the caudal medial epicondyle and the medial olecranon. This tendinous band has connections with the distal end of m. triceps brachii caput mediale and the origin of m. flexor carpi ulnaris.

The ulnar nerve travels deep to the tendinous band of m. epitrochleo-anconeus. It sends several branches into m. flexor carpi ulnaris and then travels along the deep surface of the muscle to the carpus.

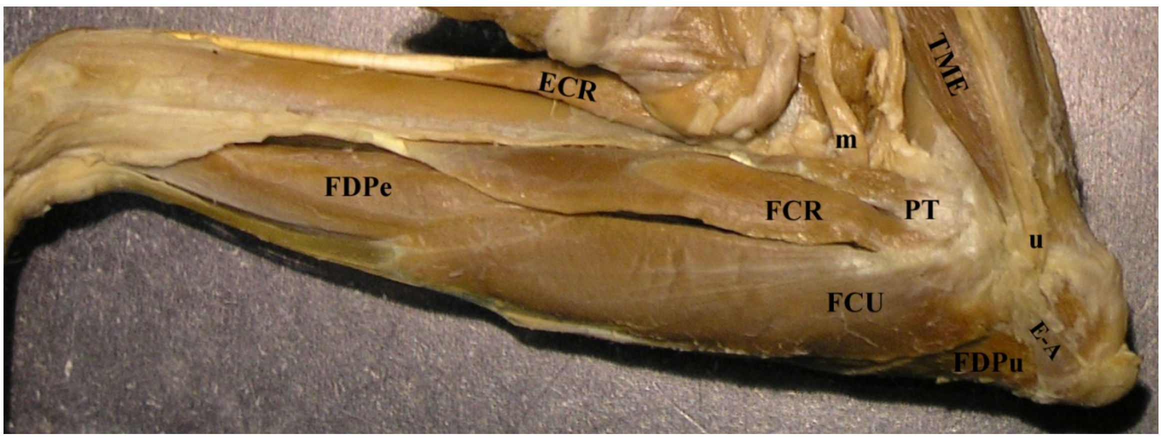


Figure 3.5B-22. Muscles originating from the medial epicondyle (P8280081).

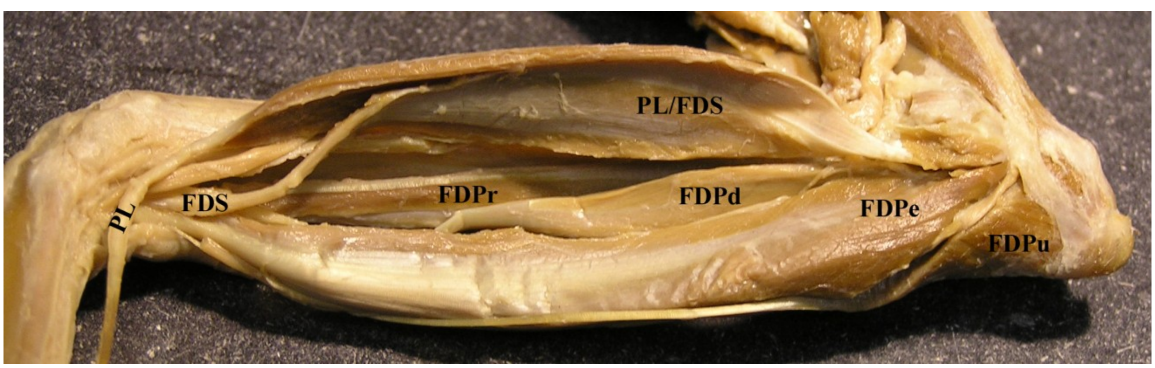
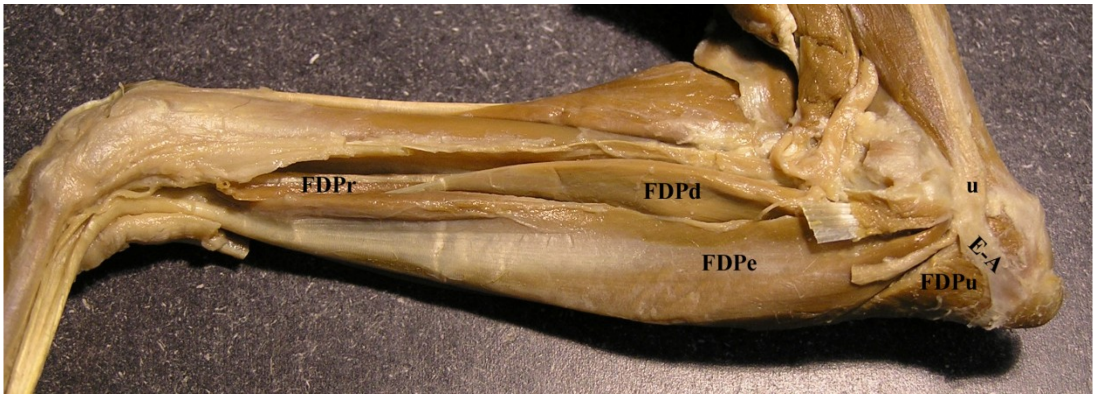
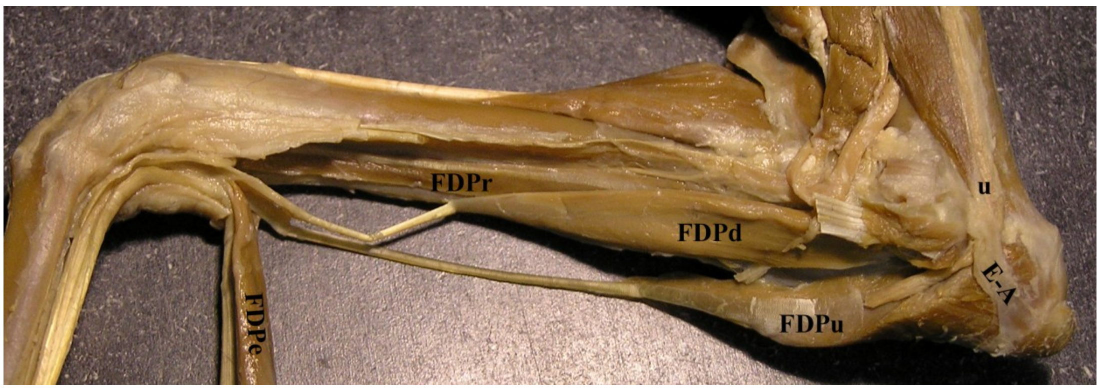


Figure 3.5B-23. Mm. flexor digitorum superficialis and palmaris longus, retracted cranially, medial view (P9150149).

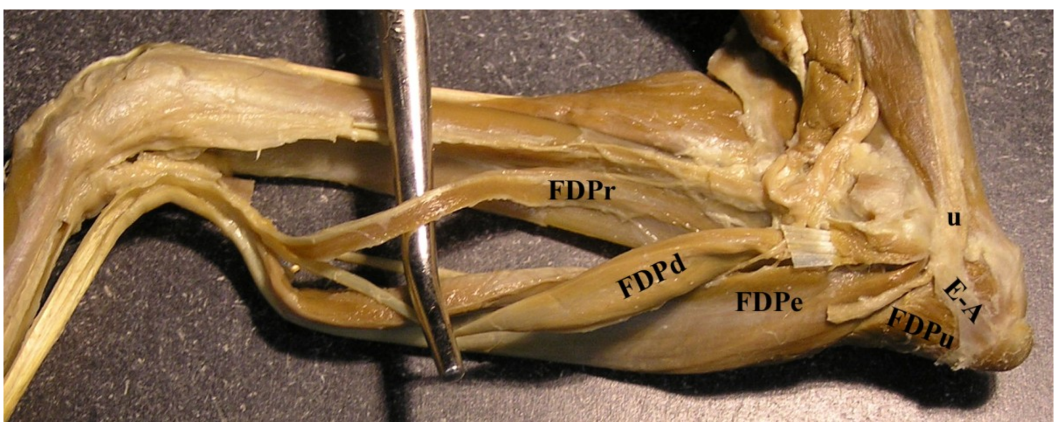
[ECR- extensor carpi radialis, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, FDPd- deep epicondylar head of flexor digitorum profundus, FDPe- superficial epicondylar head of flexor digitorum profundus, FDPr- radial head of flexor digitorum profundus, FDPu- ulnar head of flexor digitorum profundus, m- median nerve, PL- palmaris longus, PT- pronator teres, TME- triceps brachii caput mediale, u- ulnar nerve]



A.



B.



C.

Figure 3.5B-24. M. flexor digitorum profundus, medial view. A. Superficial epicondylar belly (P9150177). B. Deep epicondylar and ulnar bellies (P9150182). C. Radial belly (P9150174).

[E-A- epitrochleo-anconeus, FDPd- deep epicondylar head of flexor digitorum profundus, FDPe- superficial epicondylar head of flexor digitorum profundus, FDPr- radial head of flexor digitorum profundus, FDPu- ulnar head of flexor digitorum profundus, u- ulnar nerve]

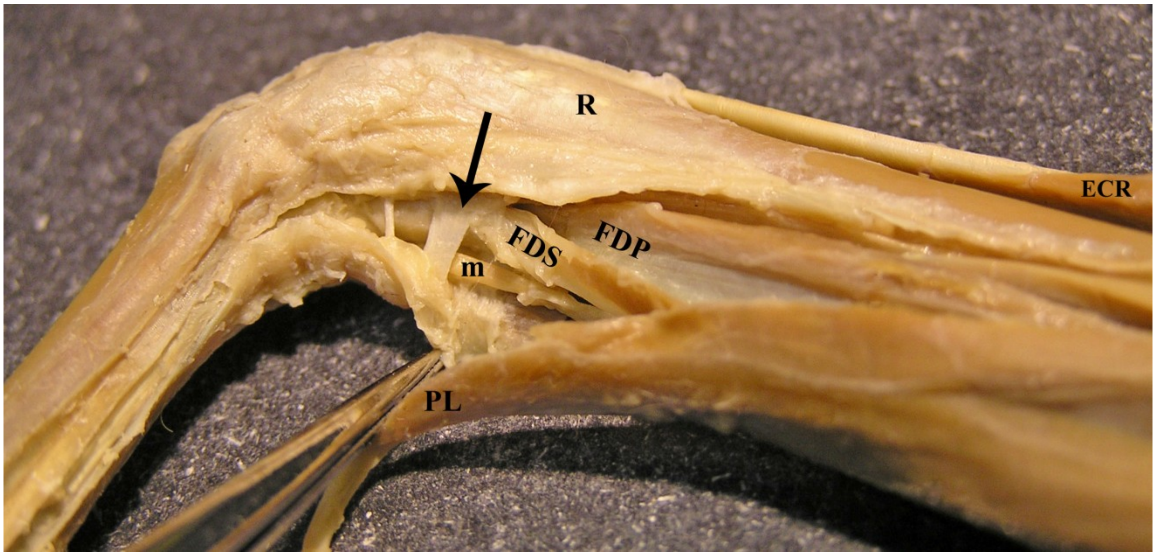


Figure 3.5B-25. Flexor retinaculum, marked by black arrow, medial view (P9150144).

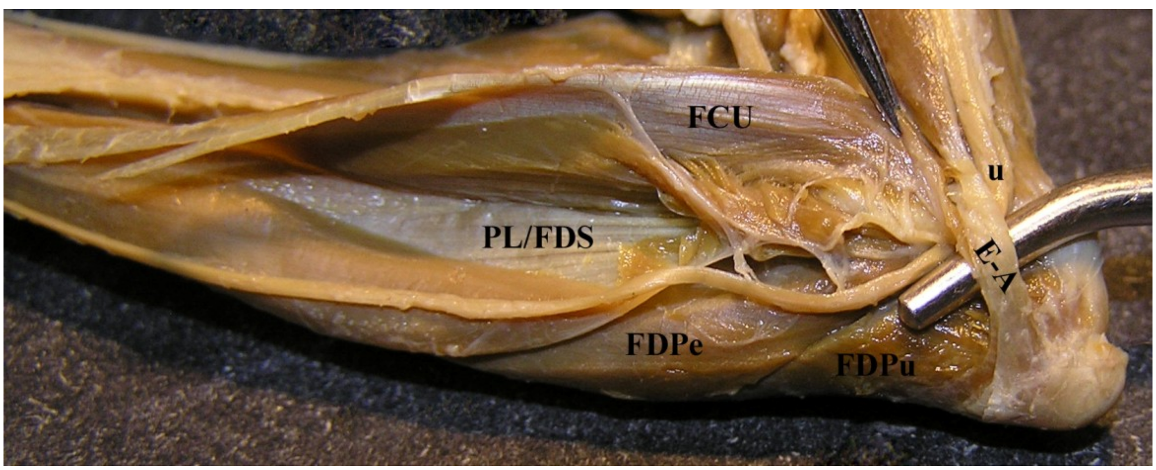


Figure 3.5B-26. Ulnar nerve, passing deep to m. epitrochleo-anconeus, medial view (P8300097).

[E-A- epitrochleo-anconeus, ECR- extensor carpi radialis, FCU- flexor carpi ulnaris, FDP- flexor digitorum profundus, FDPe- superficial epicondylar head of flexor digitorum profundus, FDPu- ulnar head of flexor digitorum profundus, FDS- flexor digitorum superficialis, PL- palmaris longus, m- median merve, R- radius, u- ulnar nerve]

M. MANUS GROUP – MEDIAN and ULNAR NERVES

mm. flexor digitorum breves manus, palmaris brevis, lumbricales, abductor digiti minimi[u], contrahentes[u], abductor pollicis brevis, flexor digitorum breves profundus[u]

Mm. flexor digitorum breves manus are absent, being fully incorporated into the tendon of m. palmaris longus to form the perforated tendon for digit IV.

M. palmaris brevis is absent in *Tragulus.*

Mm. lumbricales are represented by a few indistinct fibers situated between the tendons of m. flexor digitorum profundus to digits III and IV.

M. abductor digiti minimi is absent, or is represented by the thickened fascia on the lateral edge of digit V. The pollex is absent in *Tragulus*, as is m. abductor pollicis brevis. Mm. contrahentes are also absent in *Tragulus*.

Mm. flexor digitorum breves profundus are eight in number, one pair for each metacarpal. The pairs for the smaller digits II and V are less distinct and separable than the pairs for the more functional central digits. The paired muscles insert on the medial and lateral sides of the metacarpophalangeal joints. Opponens muscles are not differentiated from the flexor digitorum breves profundus.

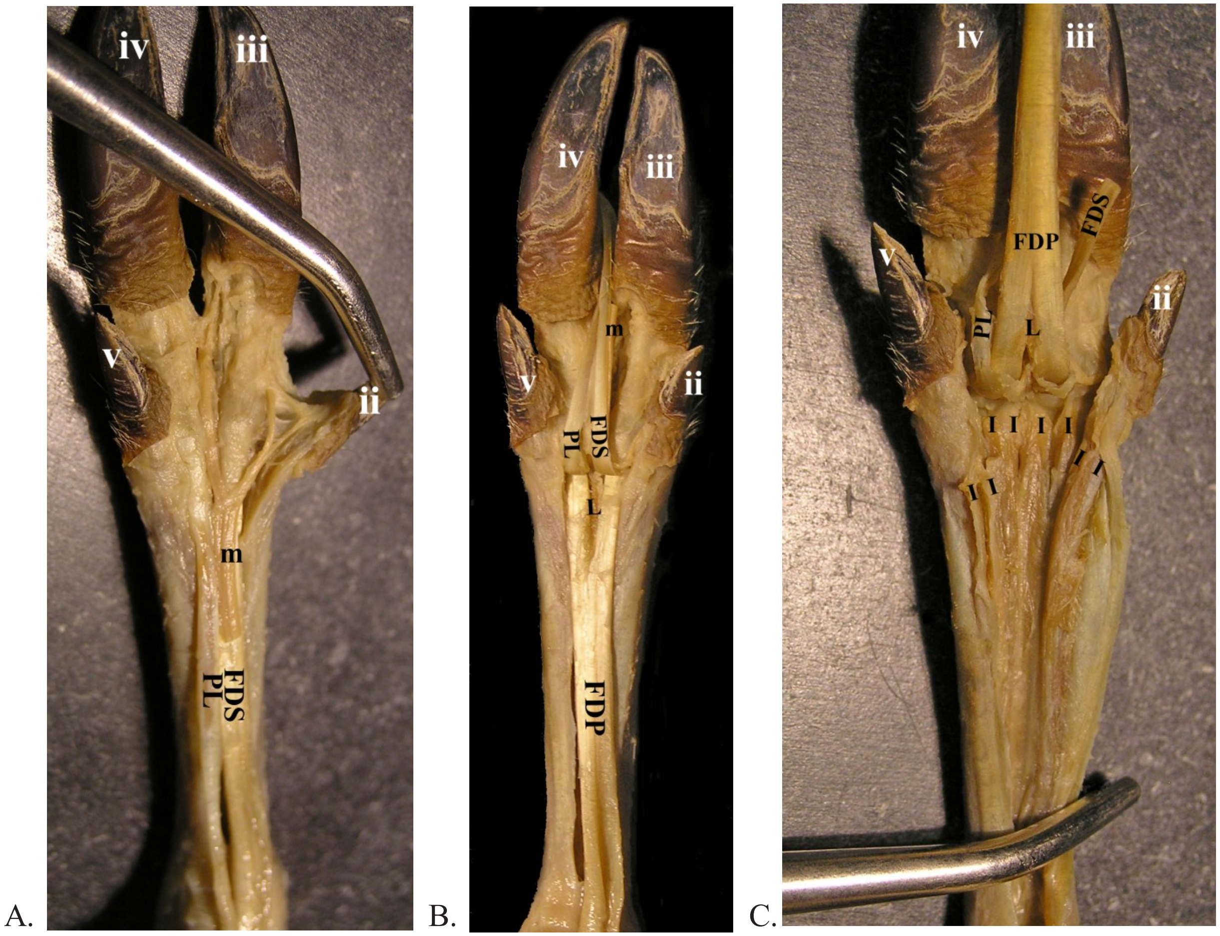
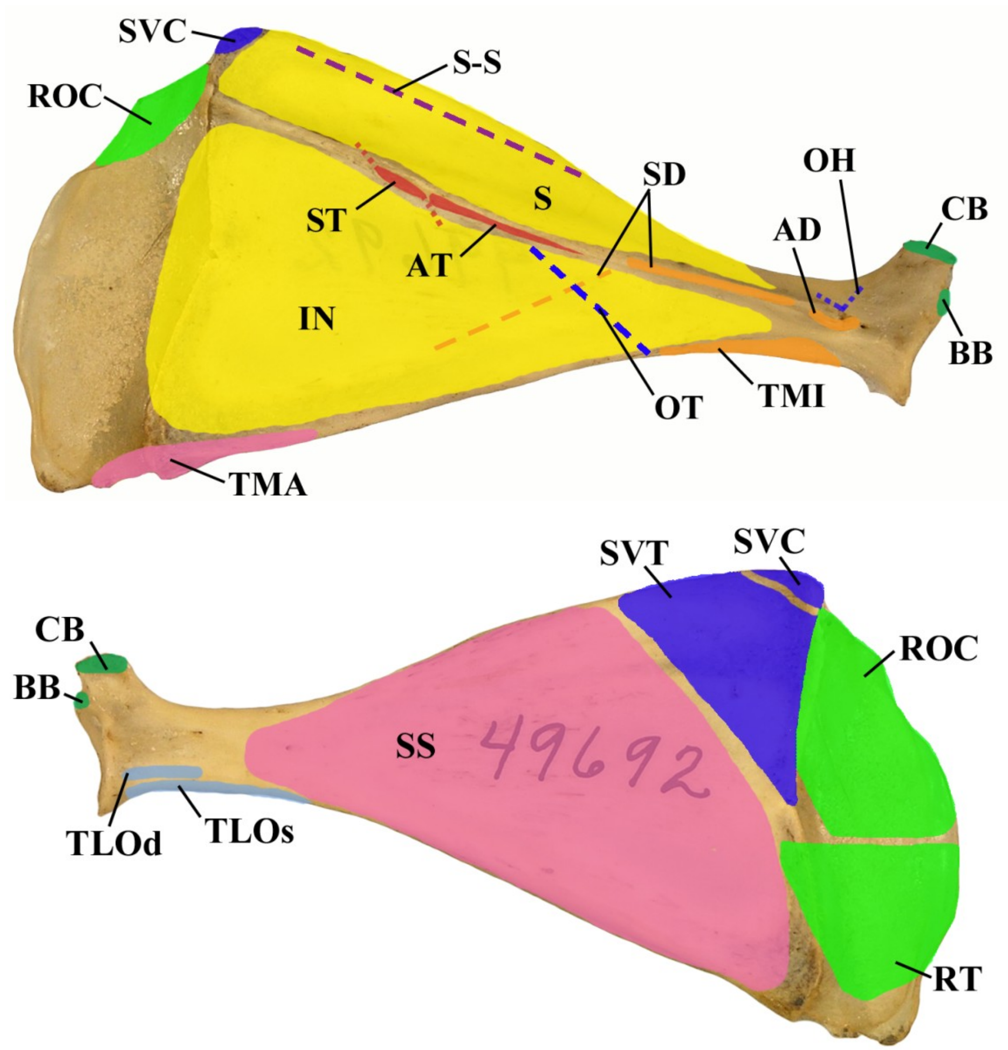


Figure 3.5B-27. Muscles of the manus. A. Median nerve in palm (P9150155). B. Mm. lumbricales and tendons of m. flexor digitorum profundus (P9150168). C. Mm. flexor digitorum breves profundus (P9150200).

FDP- flexor digitorum profundus, FDS- flexor digitorum superficialis, I- flexor digitorum breves profundus, L- lumbricales, PL- palmaris longus]



A.

B.

Figure 3.5B-28. Muscle attachment maps for the scapula.
A. Superficial surface of scapula. B. Deep surface of scapula.

[AD – acromiodeltoideus, AT – acromiotrapezius, BB – biceps brachii, CB – coracobrachialis, IN – infraspinatus, OH – omohyoideus, OT – omotransversarius, ROC – rhomboideus capitis et cervicis, RT – rhomboideus thoracis, S – supraspinatus, S-S- sternoscapularis, SD – spinodeltoideus, SS – subscapularis, ST – spinotrapezius, SVC – serratus ventralis cervicis, SVT – serratus ventralis thoracis, TLOd – triceps brachii caput longum profundus, TLOs - triceps brachii caput longum superficialis, TMA – teres major, TMI – teres minor]

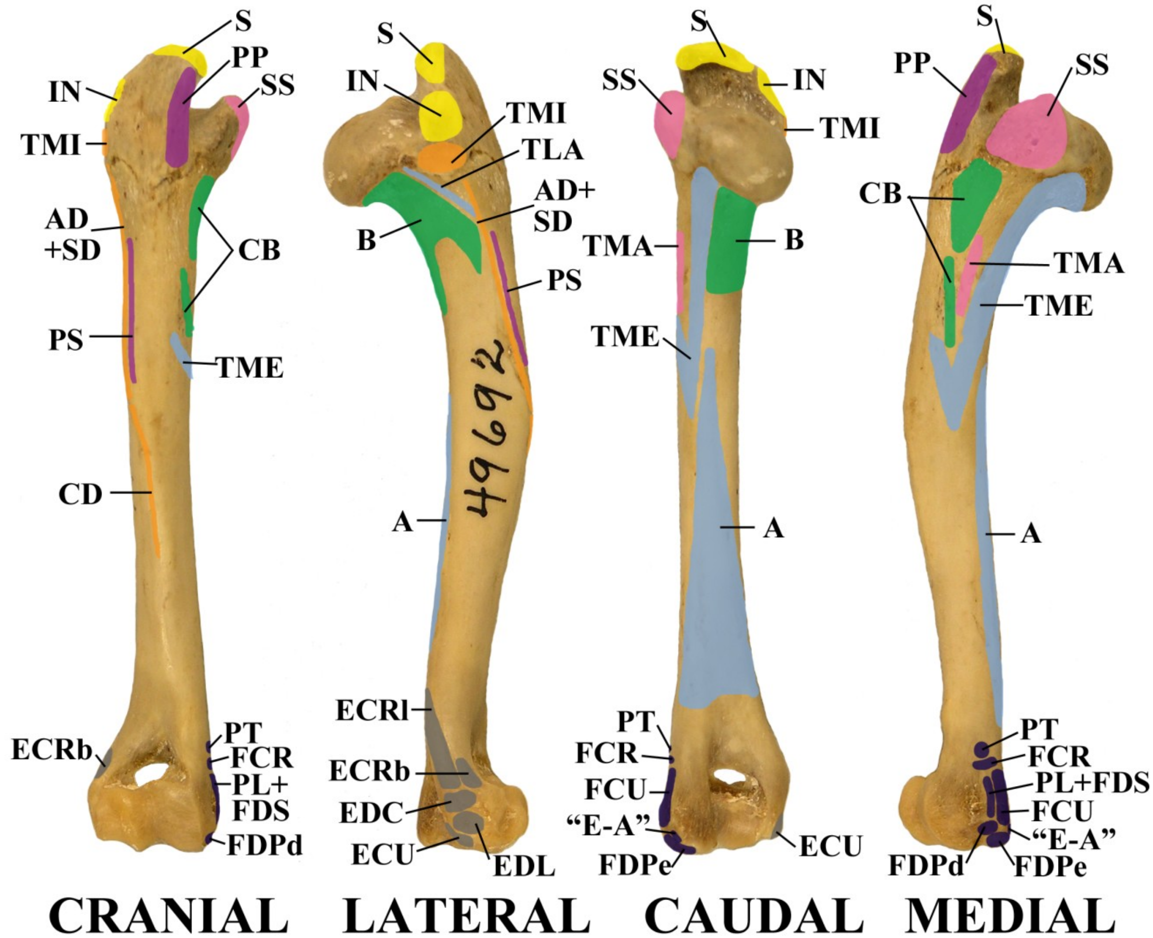


Figure 3.5B-29. Muscle attachment maps for the humerus.

[A- anconeus, AD- acromiodeltoideus, B- brachialis, CB- coracobrachialis, "E-A" – tendinous remnant of epitrochleo-anconeus, ECR- extensor carpi radialis, ECU- extensor carpi ulnaris, EDC- extensor digitorum communis, EDL- extensor digitorum lateralis, FCR- flexor carpi radialis, FCU- flexor carpi ulnaris, FDPe- superficial portion of flexor digitorum profundus, FDPd- deep portion of flexor digitorum profundus, IN- infraspinatus, LD- latissimus dorsi, PL- palmaris longus, PP- pectoralis profundus, PS – pectoralis superficialis, PT- pronator teres, S- supraspinatus, SD- spinodeltoideus, SS- subscapularis, TLA- triceps brachii caput laterale, TMA- teres major, TME- triceps brachii caput mediale, TMI- teres minor]

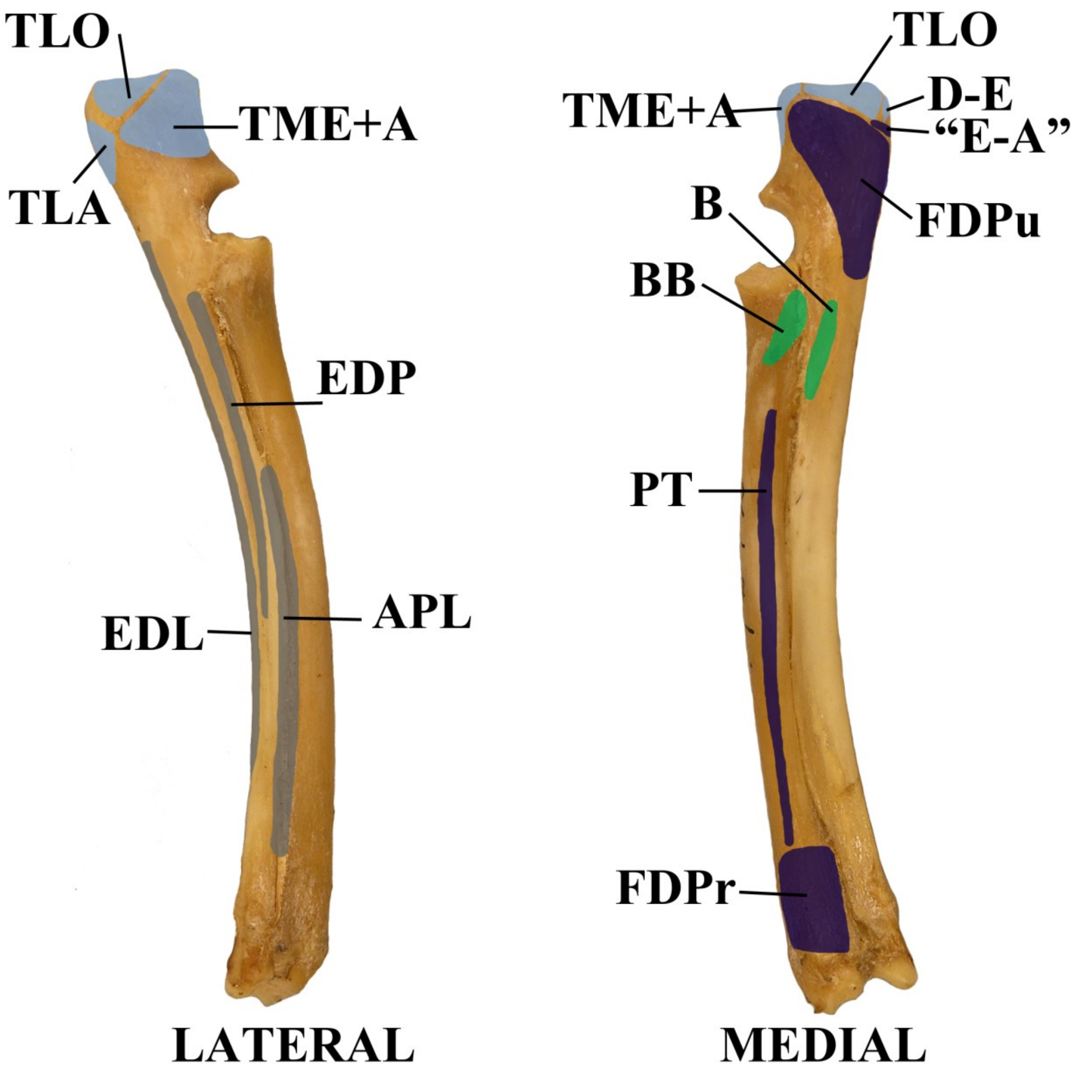


Figure 3.5B-30. Muscle attachment maps for the radius and ulna.

[A – anconeus, APL – abductor pollicis longus, B – brachialis, BB – biceps brachii, D-E – dorso-epitrochlearis, "E-A" – tendinous remnant of epitrochleo-anconeus, ECR – extensor carpi radialis, ECU – extensor carpi ulnaris, EDP – extensor digitorum profundus, FCU – flexor carpi ulnaris, FDPr – radial head of flexor digitorum profundus, FDPu – ulnar head of flexor digitorum profundus, PT – pronator teres, TLA – triceps brachii caput laterale, TLO – triceps brachii caput longum TME – triceps brachii caput mediale]

CHAPTER 4 – FEATURES OF FORELIMB MYOLOGY IN MAMMALS

"Myological terminology is in a fairly satisfactory state of standardization as regards human anatomy, but this is far from so in the case of the lower mammals. Hence, until an authoritative revision of the nomenclature with special reference to lower Mammalia has been made, no standard can be attained. Many of the usual muscle names are misleading when applied to such a mammal as the wood rat, but the coining of new terms by the individual investigator is to be deplored, and the only practical course to follow in most cases seems to be the employment of such names, established by usage, as appear best to fit the subject in hand." - A. Brazier Howell, 1926, page 24

After three years of dissection, description, and photography of the forelimb of *Oryvteropus*, seven afrothere genera, and two artiodactyl genera, and prior dissection experience with a variety of Primates, I suspected several features of interest linked *Orycteropus* with Afrosoricida. However, in order to fully compare *Orycteropus* to other mammals and best determine the phylogenetic relationships of the aardvark, I required an extensive survey of published descriptions of mammalian forelimb anatomy in all orders of mammals. This chapter summarizes the variation I observed, or that was described in the literature, by condensing this information into 60 characters. I tried to select one character per muscle, but occasionally there was more than one feature of interest, or for some muscles nothing seemed to vary in a meaningful way. All muscle homologies and interpretations discussed below are my own; see Appendix 2 for a summary table of the original terminology and brief description of the attachments of each muscle in the cited works. My dissection data are in congruence with the literature cited unless otherwise noted.

As discussed in Chapter 2, Materials & Methods, the ancestral state of each character was reconstructed onto a molecules based phylogeny (Meredith et al., 2011). In these figures, the square next to the taxon name indicates the character state(s) I observed or recorded from the literature. If unknown the box is absent. The branches of the phylogeny show ancestral character state(s) as reconstructed by parsimony in Mesquite 2.75, i.e., the ancestral state(s) that minimize the number of steps of character change given the phylogeny and observed character states (Maddison & Maddison, 2011).

0. CUTANEOUS MUSCULATURE

Fewkes (1878: 111) noted for *Tachyglossus* that the "description of these muscles is all the more interesting considering that they play such an important part in the movements of the fore-leg." I was not aware of the importance of cutaneous musculature in some groups of mammals, or its extent in the afrotheres when I began this project. Despite this ignorance, I took great care in skinning each specimen, and carefully examined the cutaneous muscles which remained fully in situ on the animal. Unfortunately, my descriptions now seem incomplete as they were focused on the forelimb attachments of the cutaneous muscle sheet rather than on the whole, and, once removed, the cutaneous muscles cannot be re-examined. A better approach to the dissection allowing for reconsideration of the muscles might be to remove the cutaneous musculature along with the skin, a technique used to examine primate facial muscles (Burrows & Smith, 2003). Areas of special attachment could be tagged with string or pins, so that these often tiny slips are not overlooked during the progression of the dissection.

Despite the shortcomings of my initial technique and the substantial confusion of terminology in the literature, the details I recorded about connections between the cutaneous musculature and the muscles of the forelimb do show some intriguing patterns. The main cutaneous layer, m. panniculus carnosus, is discussed in this chapter with mm. pectoralis. M. dorsocutaneus is discussed with the trapezius complex.

A. TRAPEZIUS GROUP – ACCESSORY NERVE and CERVICAL NERVES

Introduction to the trapezius complex

The trapezius complex is particularly confusing in the literature, because of varied and inconsistent terminology; thus this section considers the problems in detail in an effort to provide clarification and standardization. This is especially important given the difficulty I had homologizing the components of the trapezius complex in *Orycteropus* and other afrotheres.

The trapezius complex is typically comprised of five portions. I had hoped to utilize the same terminology as the Nomina Anatomica Veterinaria (2005) throughout this dissertation, but some of the terms employed therein are not appropriate for all mammals because the domesticated mammals generally observed by veterinarians are aclaviculate or nearly so (Carnivora, Perissodactyla, Artiodactyla). This is particularly the case for the components of the trapezius complex.

The “trapezius” components are three superficial dorsal muscles from the cranial, cervical, and dorsal midline to the pectoral girdle, and the “sternocleidomastoideus” components are two ventral portions from the cranium to the sternum and clavicle. All are innervated by the spinal accessory nerve and are rightfully considered to be parts of a whole, homologous with the “cucullaris muscle” of lower tetrapods (Edgeworth, 1935). I employ commonly applied terms that are most consistent with the natural positional relationships of the five portions of the trapezius complex – two ventral ‘mastoideus’ portions, mm. sternomastoideus and cleidomastoideus, and three dorsal ‘trapezius’ portions, mm. clavotrapezius, acromiotrapezius, and spinotrapezius – which are all described by the typical location of their distal attachment.

The trapezius complex can be found in all mammals in some form; however, this commonality does not facilitate studies of comparative anatomy. The five portions of the trapezius complex have overlapping areas of origin and insertion and may fuse in a variety of combinations. The muscles of the trapezius complex also have a tendency to fuse with portions of mm. deltoideus, especially in aclaviculate animals, or with m. omotransversarius along their shared border. Frequently anatomists do not discuss mm. sternomastoideus and cleidomastoideus muscles in descriptions of limb anatomy, considering the muscles to be a feature of the head and neck. Even when all portions of the trapezius complex, m. omotransversarius, and mm. deltoideus are described independently, there are many different names given to the different portions of the muscles based on differences in origin or insertion, especially in aclaviculate mammals. Thus, we are left with many questions about the true identity of muscle bellies stretching between the cranium and dorsal midline and the bones of the pectoral girdle and sternum, and what each muscle should be rightly named.

I had particular difficulty determining the homologies of the muscles of the trapezius complex within the clade Afrotheria. It is possible that these animals have in common unusual attachments of the trapezius complex. It is difficult to be more precise, as the variations are different and I am not certain about the homologies, but it seems important that the muscles of the trapezius complex are so unusual and difficult to categorize in the orders Tubulidentata, Macroscelidea, Hyracoidea, Proboscidea, Sirenia, and often in Afrosoricida. For example, the homologies of the muscles of the trapezius complex in *Trichechus* and *Dugong* are uncertain, given the confusing attachments of the muscles, and that two parts are perplexingly named “cephalohumeralis” and “brachiocephalis” even though Domning (1978) admits those terms are synonyms. However, after examining the excellent figures in Domning (1977, 1978) I have assigned names to the muscles based on their positional relationships. I have similarly made my best determination of homology for *Orycteropus* and the other orders of Afrotheria; see Appendix 2 for the original terminology and details of muscle attachments in the cited papers. In most other mammals the muscles of the trapezius complex are fairly standard and so are easier to homologize. The exception to this is Cetacea; there are only two muscles of the trapezius complex in most cetaceans (Carte & Macalister, 1868; Murie, 1873a, 1873b; Schulte & Smith, 1918; Howell, 1927; Strickler, 1976), although there are three reported for *Monodon* (Howell, 1930).

The cranial border of the monotreme scapula is homologous with the true scapular spine of therian mammals (Shrivastava, 1962b), and the monotreme ‘spine’ is homologous with the caudal border of the reptilian scapula (Romer, 1922). For this analysis, the attachments of the trapezius complex, and all other muscles attached to the scapula, will be interpreted using that information so they are most comparable to those of therian mammals.

For future dissections, special attention must be paid to the position of the great auricular nerve, which generally emerges from between m. clavotrapezius and the cranial edge of m. acromiotrapezius, and to the accessory nerve, which often travels between mm. sternomastoideus and cleidomastoideus. Also, mm. sternomastoideus and cleidomastoideus should always be discussed with the three parts of trapezius. If all components are discussed together and in relation to the great auricular and accessory nerves, each portion of the trapezius complex should be identifiable. While the muscles of the trapezius complex might not strictly be related to appendicular anatomy based on embryological development (Cheng, 1955), their shared innervation, complex relationships with true forelimb muscles such as mm. deltoideus, and superficial insertions on the bones of the pectoral girdle, necessitate a full description in order to correctly identify all the muscles of the forelimb.

See Appendix 4 for comparative images of the trapezius complex in Mammalia.

Character 1. M. sternomastoideus.
Typical origin from mastoid region (0), doubled (1), alternate origin from mandible or zygomatic (2)

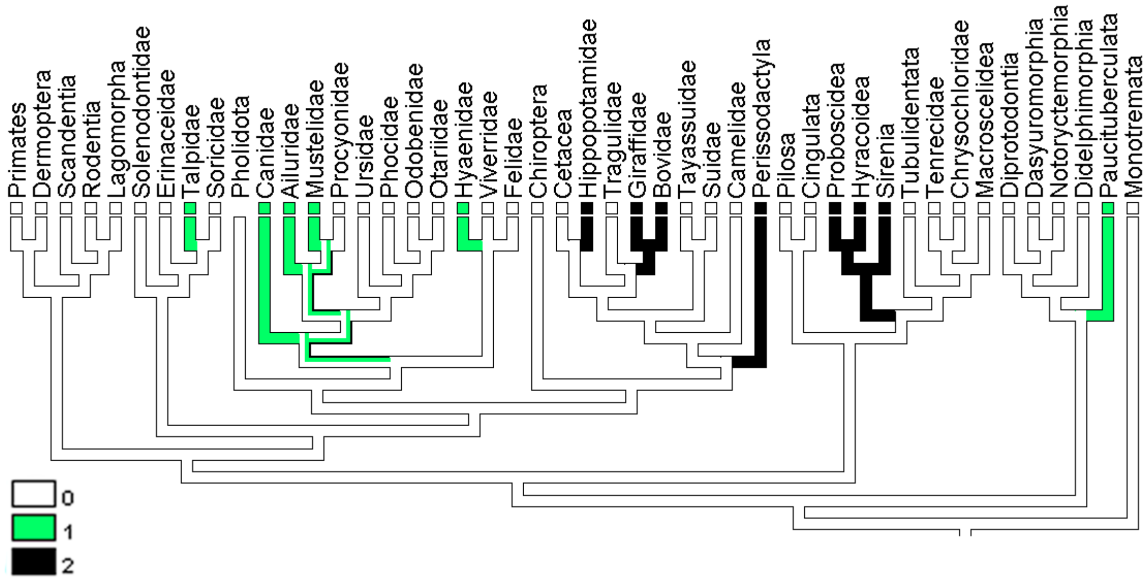


Figure 4.1. Phylogeny depicting character states of m. sternomastoideus.

M. sternomastoideus is the only portion of the trapezius complex that does not move the pectoral girdle, and it is always present in mammals except possibly *Manis* (Windle & Parsons, 1899a). It is the more superficial of the two ventral parts of the trapezius complex, typically stretching from the mastoid process of the temporal bone to the manubrium. The term sternomastoideus, which reflects these attachments, is commonly employed in the literature. Yet the muscle is called "sternocephalicus pars mandibularis / pars mastoidea / pars occipitalis" in the *Nomina Anatomica Veterinaria* (2005), which reflects some varieties of attachment observed in the domesticated mammals. Examined across Mammalia, the bony attachments of this muscle are so varied that it seems best to continue with the generic term m. sternomastoideus, rather than to attempt to parse out variation in the name of the muscle.

In *Ornithorhynchus*, m. sternomastoideus originates from the mastoid and is doubled into superficial and deep portions (Coues, 1870; Wilson, 1894; McKay, 1895); presumably one represents a differentiating m. cleidomastoideus which is not seen in *Tachyglossus* (Mivart, 1866; Fewkes, 1878).

M. sternomastoideus is typical in most Marsupialia (Coues, 1872; Young, 1882; Sidebotham, 1885; MacCormick, 1886; Wilson, 1894; Parsons, 1896b; Sonntag, 1922b; Jones, 1949; Warburton, 2003). In *Caenolestes*, however, m. sternomastoideus is comprised of two separable portions which both insert on the manubrium (Osgood, 1921).

M. sternomastoideus is typical in *Orycteropus*, Chrysochloridae, (Dobson, 1883; Parsons, 1901; Campbell, 1938; Gasc et al., 1986), Macroscelidea (Jullien, 1967), and also Tenrecidae, although frequently it is fused with its contralateral partner into a large ventral raphe (Dobson, 1882a, 1883; Verheyen, 1961; Jullien, 1967).

Within Paenungulata m. sternomastoideus is very unusual, having neither sternal nor mastoid attachments. The muscle originates from the ramus of the mandible and is fused with its contralateral partner to form a ventral raphe before inserting on the manubrium in Hyracoidea (Murie & Mivart, 1865; Windle & Parsons, 1901), or splitting into three pieces inserting one on the manubrium and one on each of the first ribs in *Elephas* (Anderson, 1883; Windle & Parsons, 1901; Shindo & Mori, 1956b). In Sirenia, the muscle I interpret as m. sternomastoideus originates from the zygomatic arch and inserts on the manubrium ("sphincter colli profundus ?pars auris" in Domning, 1977, 1978). Domning also considered this identification of the muscle (Shoshani, 1993: 249).

Similarly, in the Equidae and Tapiridae, m. sternomastoideus originates from the angle of the mandible (Murie, 1871; Sisson, 1914; Campbell, 1936; Bressou, 1961;

Budras & Sack, 2012), but I have no information on the trapezius complex of the Rhinocerotidae. In Artiodactyla m. sternomastoideus often has a slip of origin from the mandible or the fascia over the masseter (Owen, 1838; Windle & Parsons, 1901; Sisson, 1914; Campbell, 1936). In Cetacea m. sternomastoideus originates from the exoccipital – which is in the location of the mastoid process in most mammals – and inserts onto the manubrium (Howell, 1927, 1930; Strickler, 1978).

M. sternomastoideus is typical in Xenarthra (Owen, 1862; Galton, 1869a, 1869b; Humphry, 1869b; Macalister, 1869a; Murie, 1872b; Macalister, 1875a; Windle & Parsons, 1899a; Miles, 1941). In chiropterans, m. sternomastoideus is typical (Macalister, 1872).

In Erinaceidae, Solenodontidae, and Soricidae, m. sternomastoideus is typical (Dobson, 1881a, 1882b; Allen, 1910; Sharma, 1958; Gugler, 1959; Jullien, 1967; Neveu & Gasc, 2002). According to Whidden (2000), in many of the Talpidae there are two portions of m. sternomastoideus, both inserting on the manubrium [state 1]. The "sterno-occipitalis" portion originates with m. clavotrapezius, whilst the "sternomastoideus" portion originates from the base of the zygomatic arch with m. cleidomastoideus. However, Jullien (1967) and Dobson (1882b, 1883) did not find two portions of sternomastoideus in talpids.

In many feliforms, Ailuridae, Canidae, and Mustelidae, there are two portions of m. sternomastoideus, one from the occiput and one from the mastoid, both of which insert on the manubrium (Watson & Young, 1879; Windle & Parsons, 1897; Young & Robinson, 1889; Hall, 1926; Fisher, 1942; Getty, 1975; Spoor & Badoux, 1986a; Fisher, 2009; Diogo et al., 2012a; Julik et al., 2012). However, this condition is not always noted for all genera and may not be constant within these groups (Devis, 1868; Windle & Parsons, 1897; Reighard & Jennings, 1901; Hall, 1926).

In *Cynocephalus* (Diogo, 2009), *Oryctolagus* (Bensley, 1921), and Rodentia m. sternomastoideus is typical (Parsons, 1898b; Howell, 1932; Greene, 1935; Young, 1937; Wood & White, 1950; Rinker, 1954; Woods, 1972; Thorington et al., 1997; Bezuidenhout & Evans, 2005). In Scandentia and Primates, mm. sternomastoideus and cleidomastoideus are fused at their origin (Owen, 1866; Murie & Mivart, 1872; Dobson, 1881b; Primrose, 1899; Le Gros Clark, 1924, 1926; Woollard, 1925; Patterson, 1942; Miller, 1952; Schön, 1968; Standring et al., 2005).

Summary: M. sternomastoideus is attached to the ramus of the mandible in Hyracoidea and Proboscidea, as well as some Artiodactyla and Perissodactyla. In Sirenia it reaches the zygomatic arch. *Orycteropus* has a typical origin of m. sternomastoideus, as do most other mammals, and thus does not share this characteristic with ungulates or paenungulates.

Character 2. M. cleidomastoideus
Absent (0), inserts on clavicle (1), inserts on manubrium (2)

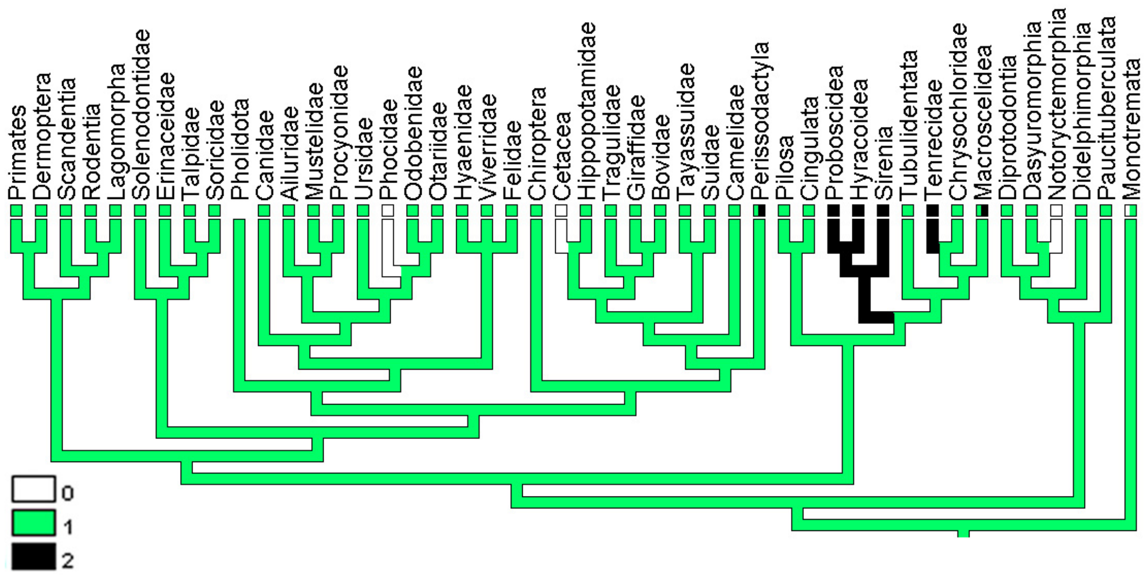


Figure 4.2. Phylogeny depicting character states of m. cleidomastoideus.

M. cleidomastoideus is the deeper portion of the two ventral parts of the trapezius complex. It typically joins the mastoid process of the temporal bone to the medial clavicle [state 1]. However, in aclaviculate mammals, m. cleidomastoideus ("cleidocephalicus pars mastoidea") is said to merge with m. clavotrapezius ("cleidocephalicus pars occipitalis / pars cervicalis") and m. clavodeltoideus ("cleidobrachialis") to form m. brachiocephalicus (Nomina Anatomica Veterinaria, 2005). M. brachiocephalicus is "one of the most dramatic adaptations of mammalian anatomy" (Jouffroy, 1971). In reality, the components of m. brachiocephalicus are essentially unchanged as they retain their innervation and positional relationships. The only difference is the replacement of a bony clavicle with a tendinous intersection (the clavicular intersection), which is a feature of the skeleton and not of the myology. Additionally, in some aclaviculate mammals such as the Hyracoidea and *Equus*, m.

omotransversarius also joins "m. brachiocephalicus," which is not addressed in the Nomina Anatomica Veterinaria (2005). In claviculate mammals, all of these components typically remain separate. Therefore, I believe it more applicable to all of Mammalia and consistent with more of the anatomical literature to utilize the general term cleidomastoideus rather than the term "cleidocephalicus."

In the Didelphimorphia, Paucituberculata, Dasyuromorphia, and Diprotodontia, m. cleidomastoideus is typical [state 1] (Coues, 1872; Young, 1882; Sidebotham, 1885; MacCormick, 1886; Parsons, 1896b; Osgood, 1921; Sonntag, 1922b; Jones, 1949). However, in *Thylacinus*, m. cleidomastoideus is very narrow and inserts into the rudimentary clavicle and also m. clavodeltoideus, a variant of the unique "marsupial trapezius" configuration discussed below (Cunningham, 1882). M. cleidomastoideus is absent in *Notoryctes*, although some fibers from m. sternomastoideus to the clavicle may represent the muscle (Warburton, 2003).

M. cleidomastoideus is typical in *Orycteropus*, originating with m. sternomastoideus from the paroccipital and mastoid processes of the temporal bone and having the usual insertions (Sonntag, 1925). The muscle is the same in Chrysochloridae (Dobson, 1883; Parsons, 1901; Campbell, 1938; Gasc et al., 1986).

In the tenrecs, identification of mm. cleidomastoideus and clavotrapezius is not certain until further dissections and developmental work can be done, but the attachments were quite clear in the specimen of *Microgale* I dissected. The muscle I interpret as m. cleidomastoideus is unusual, with a high origin from the occipital crest and an insertion on the manubrium (Dobson, 1882a, 1883; Verheyen, 1961; Jullien, 1967). There is one report in *Tenrec* of m. cleidomastoideus inserting on the clavicle (Neveu & Gasc, 2002).

A slip from m. cleidomastoideus to the pinna (Dobson, 1883) makes the muscle in *Potamogale* quite reminiscent of the unusual m. clavotrapezius in *Orycteropus*.

Although it has been reported that m. cleidomastoideus inserts on the manubrium in Macroscelidea (Jullien, 1967), the muscle appeared to insert on the medial clavicle in the three elephant shrews I dissected.

In Hyracoidea the muscle I have identified as m. cleidomastoideus is quite tiny, with an origin from the paraoccipital process and insertion onto the manubrium deep to m. sternomastoideus. In Proboscidea m. cleidomastoideus originates from the base of the zygomatic arch and inserts on the sternum (Anderson, 1883; Shindo & Mori, 1956b) or the first rib (Miall & Greenwood, 1878b). Similarly, in Sirenia the muscle I interpret as m. cleidomastoideus originates from the squamosal or paramastoid and inserts on the manubrium ("sternomastoideus" in Domning, 1977, 1978).

In *Tapirus*, m. cleidomastoideus inserts on the manubrium (Murie, 1871; Campbell, 1936), whereas in *Equus* it joins m. brachiocephalicus (Windle & Parsons, 1901; Sisson, 1914; Bressou, 1961; Budras & Sack, 2012).

M. cleidomastoideus is typical in Xenarthra (Galton, 1869a, 1869b; Humphry, 1869b; Macalister, 1869a; Murie, 1872b; Macalister, 1875a; Windle & Parsons, 1899a; Miles, 1941). It is also typical in Eulipotyphla, though there is discrepancy as to whether m. cleidomastoideus inserts on the medial or lateral end of the clavicle (Dobson, 1881a, 1882b; Allen, 1910; Sharma, 1958; Gugler, 1959; Jullien, 1967; Neveu & Gasc, 2002).

M. cleidomastoideus is typical in Chiroptera (Macalister, 1872). In Artiodactyla and Carnivora it has a typical origin from the mastoid or paroccipital, and joins m. brachiocephalicus (Murie, 1872d; Watson & Young, 1879; Allen, 1882; Kelley, 1888;

Young & Robinson, 1889; Reighard & Jennings, 1901; Hall, 1926; Howell, 1929; Fisher, 1942; Davis, 1964; Getty, 1975; Leach, 1977; Feeney, 1999; Fisher et al., 2009; Diogo et al., 2012a; Julik et al., 2012). M. cleidomastoideus may be absent in Otariidae and Phocidae (Humphrey, 1868; Murie, 1872d; Howell, 1929), and may be absent in *Manis* but this is unclear (Windle & Parsons, 1899a). In *Monodon* the "mastoscapularis" muscle, which originates from the exoccipital and inserts on m. deltoideus near the acromion, may be homologous with m. cleidomastoideus based on its accessory nerve innervation, but this muscle does not exist in other Cetacea (Howell, 1930).

In *Oryctolagus* and *Cynocephalus*, m. cleidomastoideus is typical (Bensley, 1921; Diogo, 2009). In Scandentia and Primates m. cleidomastoideus is typical, but fused with m. sternomastoideus at origin (Owen, 1866; Murie & Mivart, 1872; Dobson, 1881b; Primrose, 1899; Le Gros Clark, 1924, 1926; Woollard, 1925; Patterson, 1942; Miller, 1952; Schön, 1968; Standring et al., 2005). In rodents, m. cleidomastoideus is typical (Parsons, 1898b; Howell, 1932; Greene, 1935; Young, 1937; Wood & White, 1950; Rinker, 1954; Woods, 1972; Thorington et al., 1997; Bezuidenhout & Evans, 2005). The origin is from the auditory bulla in the Heteromyidae (Howell, 1932; Ryan, 1989).

Summary: Within Afrotheria (Paenungulata, Tenrecidae, and Macroscelidea) there is a tendency for m. cleidomastoideus to insert on the manubrium rather than the clavicle. This is highly unusual within Mammalia, though described also for *Tapirus*, and should be studied further. *Oryceropus* possibly shares this rare feature as well, given my uncertainty about the homology of the muscles of the trapezius complex in the animal.

Character 3. M. clavotrapezius[1]
Absent (0), inserts on clavicle or clavicular intersection (1), inserts on manubrium (2)

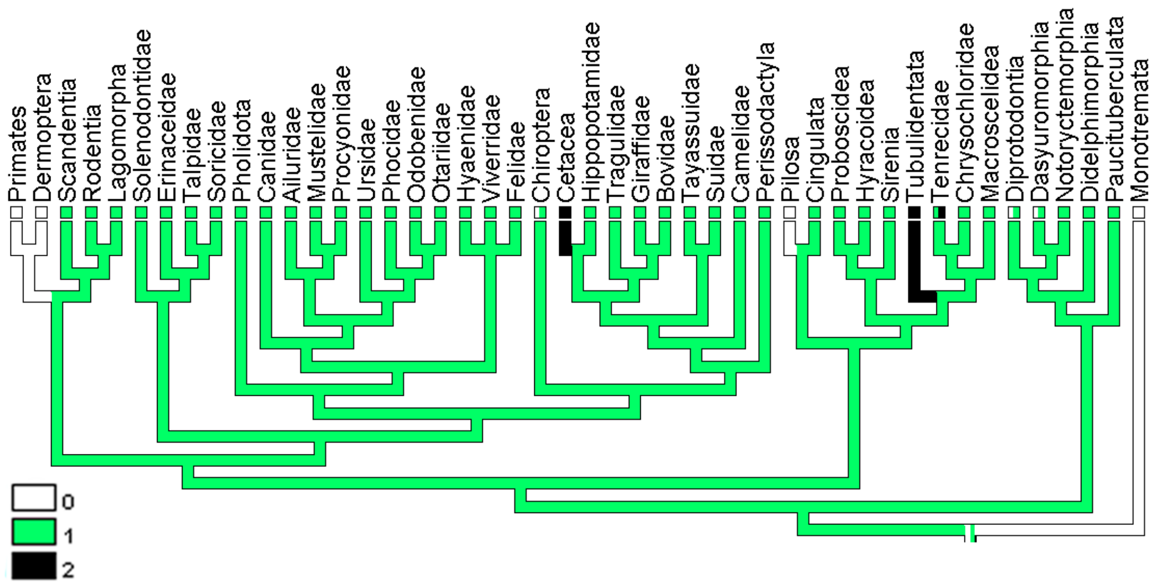


Figure 4.3. Phylogeny depicting character states of m. clavotrapezius.

M. clavotrapezius is usually the most superficial and cranial of the three dorsal components of the trapezius complex. It generally originates from the occipital crest and inserts on the clavicle. As discussed above, in aclaviculate mammals m. clavotrapezius can fuse in a variety of ways with the other muscles typically attaching on or near the clavicle. This compound muscle is called "m. brachiocephalicus," and the muscles that comprise it show distinct patterns within the different orders of aclaviculate mammals.

[1] cleido-occipital

Character 4. Components of m. brachiocephalicus[2]

The symbol / stands for the clavicular intersection or point of fusion of the component muscles – **not formed (0),**

"marsupial trapezius" = acromiotrapezius / acromio- or clavodeltoideus (1),

clavotrapezius / clavodeltoideus (2),

clavotrapezius + cleidomastoideus / clavodeltoideus (3),

clavotrapezius + omotransversarius / clavodeltoideus (4),

clavotrapezius + cleidomastoideus + omotransversarius / clavodeltoideus (5)

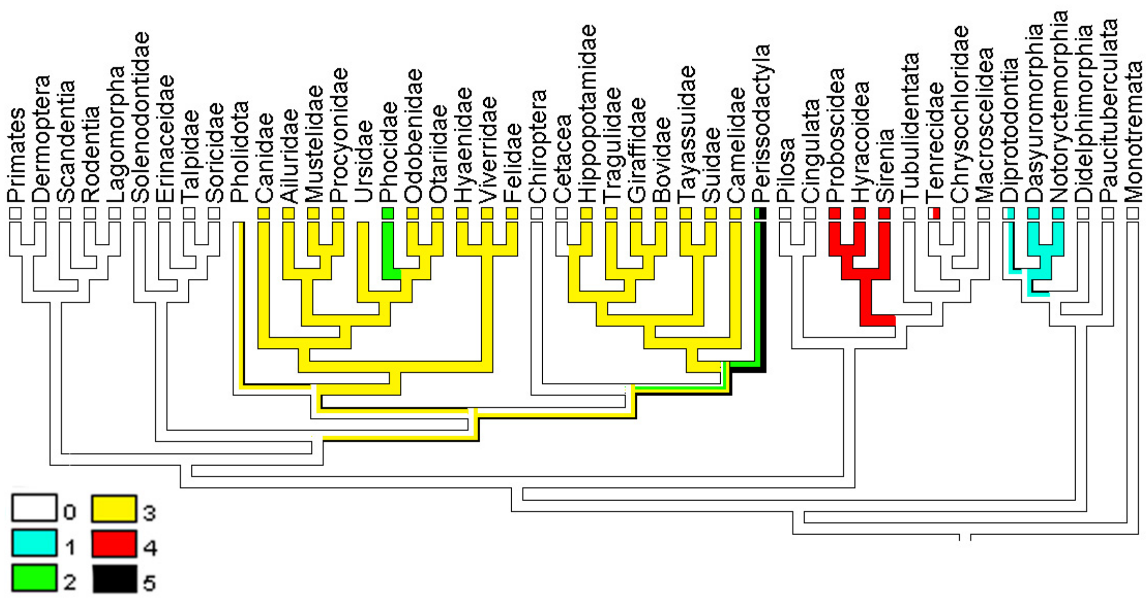


Figure 4.4 Phylogeny depicting character states of m. brachiocephalicus.

As discussed above with m. cleidomastoideus, despite the participation of m. clavotrapezius in m. brachiocephalicus in aclaviculate mammals, the term "cleidocephalicus pars occipitalis / pars cervicalis" used in the Nomina Anatomica Veterinaria (2005) should not be applied to m. clavotrapezius, as it has no connection with m. cleidomastoideus in most mammals. Another authority, Jouffroy (1971) in the *Traité de Zoologie*, calls m. clavotrapezius the "cleido-occipital" portion of

[2] cephalobrachialis, cephalohumeralis, mastohumeral, mastoido-brachialis

"sternocleidomastoideus." I find the inclusion of m. clavotrapezius with mm. sternomastoideus and cleidomastoideus confusing for two reasons: m. clavotrapezius is often fused at origin with m. acromiotrapezius and rarely with mm. sternomastoideus or cleidomastoideus, and its origin is generally more dorsal or superficial than the origins of mm. sternomastoideus or cleidomastoideus and separated from them by the great auricular nerve. As there are a variety of terms for this muscle, I have used here the simplest term found in the literature: m. clavotrapezius.

In Didelphimorphia, the only description of m. clavotrapezius is for *Chironectes*, in which it was typical [state 1 character 3, state 0 character 4] (Sidebotham, 1885). M. clavotrapezius is also typical in *Notoryctes* (Warburton, 2003), *Caenolestes* (Osgood, 1921), and most Dasyuromorphia (Cunningham, 1882; MacCormick, 1886). In *Dasyurus*, the narrow m. clavotrapezius is closely applied to the rest of the trapezius complex, although the great auricular nerve emerges from between them (MacCormick, 1886). In *Thylacinus* m. clavotrapezius is absent (Cunningham, 1882). M. clavotrapezius also seems to be absent in many Diprotodontia; a separate m. clavotrapezius muscle is described in a few diprotodonts, in which case m. acromiotrapezius is lacking a clavicular attachment (Cunningham, 1882; Young, 1882).

In Dasyuromorphia (Cunningham, 1882; MacCormick, 1886; Jones, 1949), Notoryctemorphia (Wilson, 1894; Warburton, 2003), and Diprotodontia (Macalister, 1870; Cunningham, 1882; Young, 1882; Sonntag, 1922b) the cranial-most fibers of trapezius pass over the clavicle and acromion to insert into the humerus in combination with m. acromiodeltoideus or m. clavodeltoideus. Shrivastava (1962a) does not regard this compound muscle as homologous to the similarly configured m. brachiocephalicus of eutherians, thus, the arrangement is often called the "marsupial trapezius."

In *Orycteropus* m. clavotrapezius is highly unusual and has previously been unrecognized as such; it originates from the base of the pinna and inserts into its opposite partner and the manubrium in fusion with m. sternomastoideus (the "depressor auris" in Galton, 1868, and Humphry, 1868; "depressor auriculae" in Sonntag, 1925). The "occipito-frontalis" of *Didelphis* originates from the occipital crest and ligamentum nuchae, sends a slip to the ear, and ends around the zygoma (Coues, 1872). It is possible that m. clavotrapezius of *Orycteropus*, with its connection to the pinna, is fused with or derived from a similar cutaneous muscle. I observed slips connecting m. clavotrapezius to the pinna in *Rhynchocyon* and *Heterohyrax*, and there are also connections between the pinna and trapezius in *Elephas* (Shindo & Mori, 1956b), but no connection between mm. clavotrapezius and sternomastoideus. Such slips are easily destroyed in skinning and may be more prevalent in mammals.

In Chrysochloridae, m. clavotrapezius inserts on the medial clavicle or sternoclavicular joint rather than the lateral clavicle (Dobson, 1883; Gasc et al., 1986). The muscle I interpret as m. clavotrapezius in Tenrecidae originates from the occipital crest and inserts on the vestigial clavicle in *Potamogale* (Jullien, 1967) and on the lateral clavicle in *Microgale* and in one description of *Tenrec* (Neveu & Gasc, 2002). Dobson (1882), however, reported that m. clavotrapezius of *Tenrec* inserts on the sternum. In my specimen of *Potamogale*, it appeared that m. clavotrapezius and the vestigial m. omotransversarius fuse with m. clavodeltoideus at the fibrous clavicle, forming a variant of m. brachiocephalicus [state 4 character 4] similar to that seen in the Paenungulata.

In *Elephantulus*, m. clavotrapezius originates from the occipital crest, whereas in *Petrodromus*, *Macroscelides*, and *Rhynchocyon*, the tiny ribbon of m. clavotrapezius originates with m. acromiotrapezius and then separates to insert on the clavicle. In *Rhynchocyon*, m. clavotrapezius crosses deep to m. omotransversarius rather than superficial as is typical, seemingly the only mammal in which this occurs. The insertion of m. clavotrapezius seems to be more often into the medial clavicle than the lateral clavicle (Jullien, 1967).

In Hyracoidea and Proboscidea m. clavotrapezius and the ventral portion of m. omotransversarius fuse with m. clavodeltoideus at the clavicular intersection, forming a variant of m. brachiocephalicus [state 4 character 4], as it does not include m. cleidomastoideus (Miall & Greenwood, 1878a, 1878b; Anderson, 1883; Shindo & Mori, 1956b). In Sirenia m. clavotrapezius has no bony attachment but originates from an aponeurosis between the zygomatic process and sigmoid ridge of the squamosal (the "cephalohumeralis" in Domning, 1977). As in the other Paenungulata, m. clavotrapezius joins with the muscle I consider to be the ventral portion of m. omotransversarius ("anteriorly a separate slip" of trapezius, in Domning, 1977: 18) and fuses with m. clavodeltoideus at the clavicular intersection.

M. clavotrapezius is typical in the Dasypodidae (Galton, 1869a; Murie, 1872b; Macalister, 1875a; Miles, 1941), but there is no m. clavotrapezius in *Bradypus* (Macalister, 1869a), or in the anteaters (Owen, 1862; Galton, 1869b; Humphry, 1869b). In *Euphractus*, there is an "offset" from m. acromiotrapezius, which passes deep to m. omotransversarius to insert on the strong fascia of the shoulder (Galton, 1869a). In *Dasypus*, a similar slip inserts on the aponeurosis over m. spinodeltoideus (Miles, 1941), and in Pilosa with m. clavodeltoideus (Humphry, 1869b). This sounds remarkably similar to the “marsupial trapezius” but is formed from m. acromiotrapezius rather than m. clavotrapezius and so is not considered here.

M. clavotrapezius is typical in all the Eulipotyphla [state 1 character 3, state 0 character 4], though again there is some discrepancy in the literature as to whether m. clavotrapezius inserts on the medial or lateral end of the clavicle and thus whether it is medial or lateral to the insertion of m. cleidomastoideus (Dobson, 1881a, 1882b, 1883; Sharma, 1958; Gugler, 1959; Jullien, 1967; Neveu & Gasc, 2002). M. clavotrapezius inserts on the manubrium in the talpid *Uropsilus* (Whidden, 2000).

M. clavotrapezius is usually absent in Chiroptera. In *Pteropus*, however, m. clavotrapezius inserts on the upper margin of the patagium with some cutaneous muscles (Humphry, 1869a), whereas in phyllostomids a few slips of muscle extend from the sixth and seventh cervical spinous processes to the lateral part of the clavicle (Macalister, 1872).

In *Tapirus* m. clavotrapezius joins with m. clavodeltoideus at the clavicular intersection to form a reduced m. brachiocephalicus (Murie, 1871; Campbell, 1936). In *Equus* there is a slightly different situation, as mm. cleidomastoideus, clavotrapezius, and omotransversarius all fuse with m. clavodeltoideus at the clavicular intersection to form m. brachiocephalicus (Windle & Parsons, 1901; Sisson, 1914; Bressou, 1961; Budras & Sack, 2012).

In Artiodactyla mm. cleidomastoideus and clavotrapezius fuse with m. clavodeltoideus at the clavicular intersection, forming m. brachiocephalicus (Windle & Parsons, 1901; Sisson, 1914; Campbell, 1936; Getty, 1975; Smuts & Bezuidenhout, 1987; Kneepkins et al., 1989; Nomina Anatomica Veterinaria, 2005; Fisher et al., 2007). M. omotransversarius is found between mm. clavotrapezius and acromiotrapezius, which it crosses over to insert on the fascia of the scapula (Windle & Parsons, 1901). In Cetacea the "mastohumeralis" muscle, which may be homologous with m. clavotrapezius, originates from the exoccipital superficial to m. sternomastoideus and inserts on the medial side of the cranial surface of the head of the humerus (Carte & Macalister, 1868; Murie, 1873a, 1873b; Howell, 1927, 1930; Strickler, 1976).

In Carnivora m. brachiocephalicus is the chief extensor of the forelimb (Davis, 1964), thus m. clavotrapezius is very well developed (Murie, 1872d). M. brachiocephalicus is configured the same as in Artiodactyla, although sometimes there is a clavicle (Devis, 1868; Murie, 1872d; Watson & Young, 1879; Allen, 1882; Mivart, 1882; Shepherd, 1883; Kelley, 1888; Young & Robinson, 1889; Beddard, 1900; Reighard & Jennings, 1901; Hall, 1926; Fisher, 1942; Davis, 1964; Getty, 1975; Leach, 1977; Spoor & Badoux, 1986a; Feeney, 1999; Fisher, 2009; Diogo et al., 2012a; Julik et al., 2012). M. cleidomastoideus may be absent or may not contribute to m. brachiocephalicus in Otariidae, Phocidae, and *Manis* (Humphrey, 1868; Murie, 1872d; Windle & Parsons, 1899a; Howell, 1929).

In Scandentia m. clavotrapezius is typical, and the spinal accessory nerve passes between mm. cleidomastoideus and clavotrapezius (Le Gros Clark, 1924, 1926). In *Cynocephalus*, m. clavotrapezius is absent (Diogo, 2009). M. clavotrapezius is also absent in Primates, except for an "occipital slip" in *Callimico* (Hill, 1959) and a "cleido-occipital" in *Chlorocebus* (Dobson, 1881b). In *Oryctolagus* m. clavotrapezius is typical (Bensley, 1921).

In Rodentia m. clavotrapezius is present in Heteromyidae (Ryan, 1989), Hystricomorpha (Parsons, 1896a; Howell, 1932; Greene, 1935; Wood & White, 1950; Rinker, 1954; Woods, 1972), and Sciuromorpha (Thorington et al., 1997; Bezuidenhout & Evans, 2005), and is sometimes present in Ctenomyidae (Woods, 1972). As is typical, the great auricular nerve separates mm. clavotrapezius and acromiotrapezius (Hill, 1937; Rinker, 1954), as does the distal end of m. omotransversarius (Parsons, 1896a).

Summary: In *Orycteropus* and *Tenrec* (Dobson, 1882) m. clavotrapezius has an aberrant insertion on the manubrium. M. clavotrapezius has an aberrant course deep to m. omotransversarius in *Rhynchocyon*. In many other mammals m. clavotrapezius inserts on the clavicle or is absent. Also unusual is the composition of m. brachiocephalicus within Paenungulata; the compound muscle lacks m. cleidomastoideus and includes the ventral portion of m. omotransversarius instead. This also seems to be the case in the specimen of *Potamogale* I dissected, although homology is uncertain there. *Orycteropus* lacks m. brachiocephalicus, as do Afrosoricida (except *Potamogale*) and Macroscelidea, thus in this feature they contrast with ungulates which possess a strong m. brachiocephalicus.

Character 5. M. acromiotrapezius origin
Attached to the cranium no (0), yes (1)

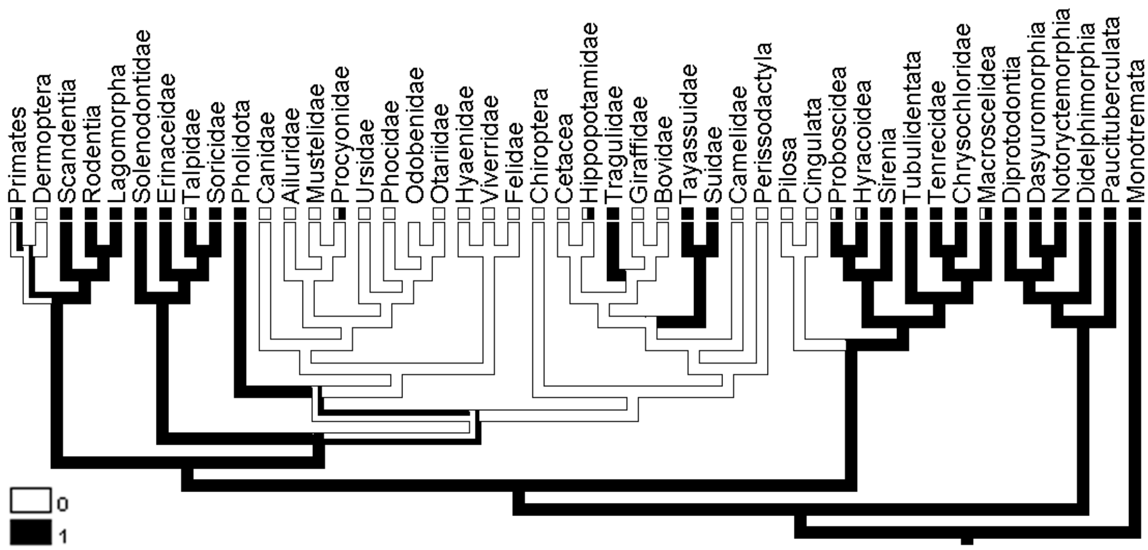


Figure 4.5. Phylogeny depicting character states of m. acromiotrapezius origin.

Character 6. M. acromiotrapezius insertion
Absent (0), acromion, spine of scapula, and clavicle (1), acromion + spine of scapula (2), metacromion only (3), spine of scapula or fascia superficial to spine (4)

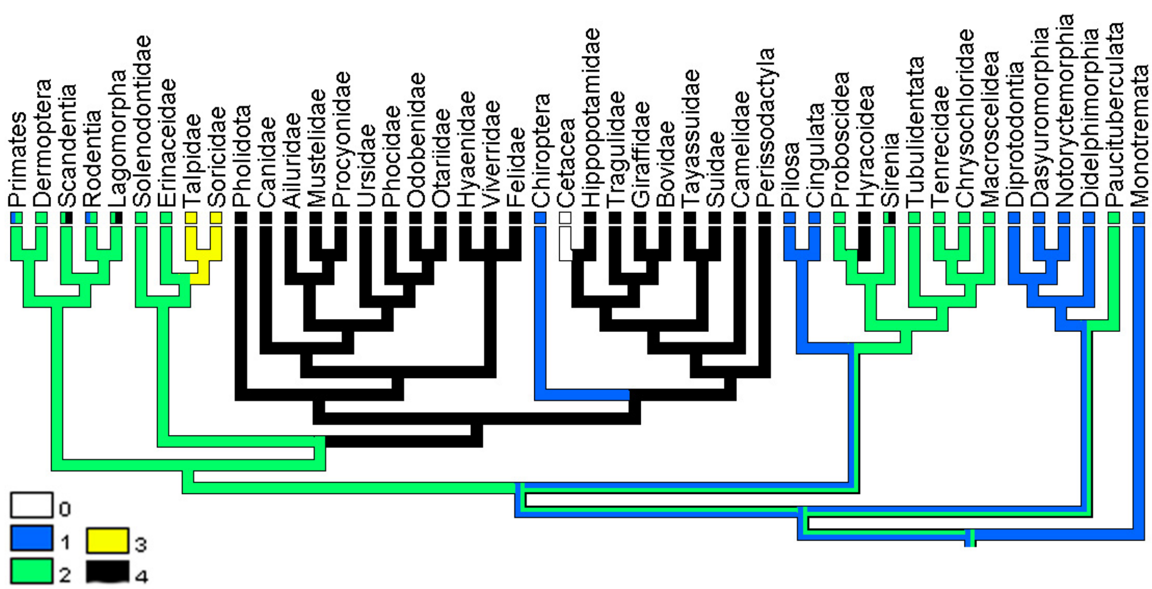


Figure 4.6. Phylogeny depicting character states of m. acromiotrapezius insertion.

Character 7. M. acromiotrapezius – bifid
no (0), yes (1)

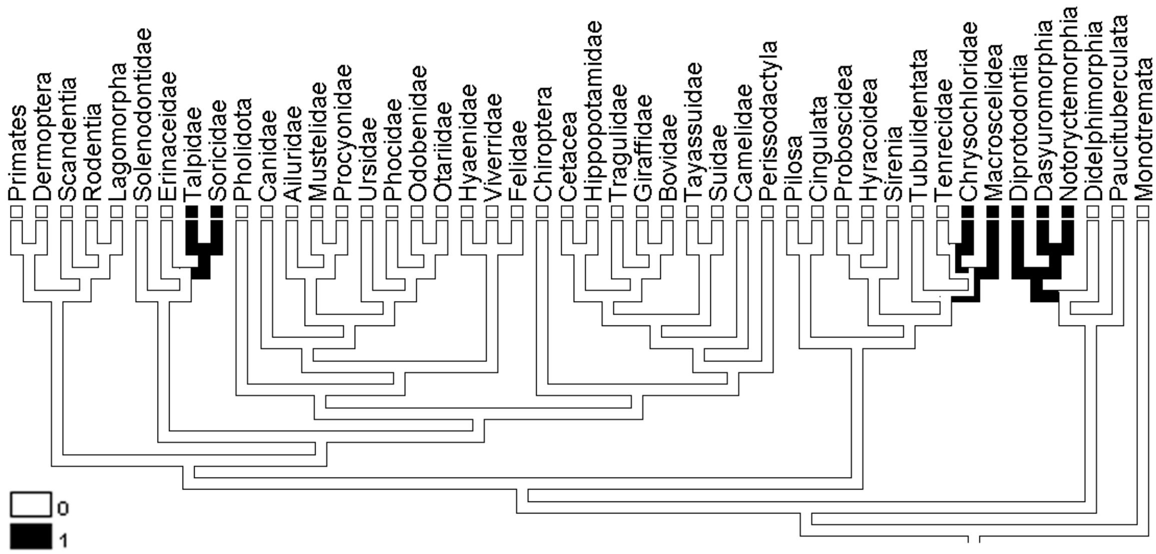


Figure 4.7. Phylogeny depicting character states of m. acromiotrapezius.

M. acromiotrapezius is arranged more toward the dorsal midline and more caudad than m. clavotrapezius. M. acromiotrapezius generally originates from the occipital crest, the ligamentum nuchae or spinous processes of cervical vertebrae, and the spinous processes of proximal thoracic vertebrae. The number of vertebrae of origin is determined with difficulty and can vary even within species, so is not considered an important character here. Generally, the muscle inserts on the scapular spine and acromion, thus the term m. acromiotrapezius was selected to reflect this insertion and to remain consistent with the term selected for m. clavotrapezius. However, there is nothing wrong with the term “trapezius pars cervicalis” employed by the Nomina Anatomica Veterinaria (2005).

At origin along its cranial edge m. acromiotrapezius may be closely applied to or fused with m. clavotrapezius, and the two muscles are often described together under the name “trapezius anterior” in the anatomical literature. Thus, presence or absence of a cranial origin of m. acromiotrapezius is difficult to ascertain from the literature, since authors may offer a fused m. clavotrapezius as part of the description. In addition, at origin along its caudal edge it may be closely applied to or fused with m. spinotrapezius, and the two muscles described only as "trapezius," such as in humans. There is also the tendency for authors to describe a "clavicular portion of trapezius" and it is not always clear whether this is merely a portion of m. acromiotrapezius inserting onto the clavicle, or whether it is m. clavotrapezius. Thus, m. acromiotrapezius is extremely difficult to compare accurately, and additional comparative dissections are needed.

In Monotremata the anterior portion of the dorsal trapezius complex originates from the cranium, possibly a fused mm. clavotrapezius and acromiotrapezius. It inserts on the scapular spine, the acromion, and the clavicle (Mivart, 1866; McKay, 1895; Allen, 1912; Walter, 1988).

In Didelphimorphia, Dasyuromorphia, and most Diprotodontia mm. acromiotrapezius and spinotrapezius are fused into one sheet, originating from the occiput and along the cervical and thoracic vertebrae (Macalister, 1870; Coues, 1872; Cunningham, 1882; Sidebotham, 1885; MacCormick, 1886; Jones, 1949; Jenkins & Weijs, 1979; Stein, 1981). As in Monotremata, the muscle inserts on the acromion and spine of the scapula and may also be attached to the clavicle (Macalister, 1870; Cunningham, 1882; MacCormick, 1886; Parsons, 1896b; Sonntag, 1922b; Jones, 1949; Jenkins & Weijs, 1979; Stein, 1981; Harvey & Warburton, 2010). In *Notoryctes* m. acromiotrapezius has an occipital and vertebral origin but there is also a separate m. spinotrapezius (Wilson, 1894; Warburton, 2003).

In *Orycteropus* the origin of m. acromiotrapezius reaches the occiput and is mostly fused with m. spinotrapezius, though it has the typical insertions on the acromion and spine of the scapula (Sonntag, 1925).

There is some disagreement in the literature about the bony attachments of m. acromiotrapezius in the golden moles. Jullien (1967) found that m. acromiotrapezius in *Chrysochloris* was bifid and inserted on both the metacromion and the tuberosity of the scapular spine, while Puttick & Jarvis (1977) noted only a single insertion onto the spine of the scapula. Campbell (1938) also described a divided m. acromiotrapezius in *Chrysospalax*, but with both portions inserting onto the metacromion. In *Calcochloris*, I noted a weak bifurcation of the muscle. Unlike many talpids, m. acromiotrapezius originates from the occiput in Chrysochloridae. M. acromiotrapezius is bifid distally in Macroscelidea, and inserts one piece on the metacromion and the other on the spine of the scapula (Jullien, 1967).

M. acromiotrapezius is typical and has an occipital origin in Hyracoidea, although some fibers from the cranial edge of m. acromiotrapezius may be involved with m. panniculus carnosus (Murie & Mivart, 1865). In *Procavia* and *Heterohyrax* I observed an insertion on the fascia of m. infraspinatus, similar to the insertion of m. acromiotrapezius in Artiodactyla. In *Dugong*, mm. acromiotrapezius and spinotrapezius are mostly fused together and also insert along a tendinous band crossing above the infraspinatus, fusing with mm. deltoideus at this point (Domning, 1977).

An interesting feature of the Dasypodidae is the origin of m. acromiotrapezius from the carapace instead of the occiput (Macalister, 1875a; Windle & Parsons, 1899a; Miles, 1941). It has a typical insertion on the acromion and scapular spine (Galton, 1869a; Murie, 1872b; Macalister, 1875a; Miles, 1941). There is also one record of a clavicular insertion (Macalister, 1875b), but Galton (1869) states clearly that no fibers of the trapezius insert on the clavicle in *Euphractus*.

In the anteaters, the fused mm. acromiotrapezius and spinotrapezius inserts on the caudal edge of the scapular spine and the lateral clavicle (Galton, 1869b; Humphry, 1869b). In *Cyclopes* the origin is not clear; it may reach the occiput (Galton, 1869b) or it may be vertebral only (Humphry, 1869b). In *Choloepus*, the muscle may reach the occiput (Windle & Parsons, 1899a), but in *Bradypus* its origin does not reach the occiput (Humphry, 1869b; Macalister, 1869a). Humphry (1869b) found an attachment to the rudimentary clavicle in the sloths, but Macalister (1869a) did not. The characters states for Xenarthra are thus tentative.

M. acromiotrapezius is typical [state 1 character 5, state 2 character 6, state 0 character 7] in Erinaceidae and Solenodontidae (Dobson, 1881a, 1882b; Parsons, 1898a; Allen, 1910; Jullien, 1967; Neveu & Gasc, 2002). In the Soricidae and in most descriptions of the Talpidae, m. acromiotrapezius only inserts on the tip of the metacromion (Dobson, 1883; Reed, 1951; Sharma, 1958; Gugler, 1959; Jullien, 1967; Whidden, 2000; Neveu & Gasc, 2002). In some soricids and talpids it may be a bifid muscle with two metacromial insertions covered by m. omotransversarius at insertion (Campbell, 1939; Reed, 1951; Sharma, 1958; Gugler, 1959; Whidden, 2000). In the most fossorial talpids, m. acromiotrapezius is weak and loses its occipital origin (Jullien, 1967; Whidden, 2000). This is similar to the thin m. acromiotrapezius seen in the fossorial chrysochlorids and the marsupial mole *Notoryctes* (Warburton, 2003). In *Mogera*, *Talpa*, *Scalopus*, *Parascalops*, and *Scapanus*, m. acromiotrapezius is atrophied to only a few muscle fibers in some connective tissue (Campbell, 1939; Reed, 1951; Gaughran, 1954; Jullien, 1967; Whidden, 2000).

M. acromiotrapezius does not reach the occiput in Chiroptera, and inserts on the clavicle, acromion, and spine of the scapula (Humphry, 1869; Macalister, 1872; Vaughan, 1959; Hermanson & Altenbach, 1983).

In Carnivora m. acromiotrapezius does not originate from the occiput and is lacking an insertion on the acromion; rather it inserts solely on the spine of the scapula in conjunction with m. omotransversarius (Devis, 1868; Humphry, 1868; Murie, 1872d; Allen, 1882; Ross, 1883; Watson & Young, 1879; Windle, 1888; Young & Robinson, 1889; Windle & Parsons, 1897; Beddard, 1900; Hall, 1926; Howell, 1929; Fisher, 1942; Davis, 1964; Getty, 1975; Leach, 1977; Gilbert, 1984; Spoor & Badoux, 1986a; Feeney, 1999; Fisher, 2009; Diogo et al., 2012a; Julik et al., 2012).

Similarly, in Artiodactyla, the origin of m. acromiotrapezius does not reach the occiput in the longer-necked artiodactyls such as *Camelus* (Smuts & Bezuidenhout, 1987) and *Giraffa* (Owen, 1838; Murie, 1872c), and also often in bovids (Windle & Parsons, 1901; Sisson, 1914; Campbell, 1936; Getty, 1975). It does, however, reach the occiput in the Suina (Sisson, 1914; Campbell, 1936; Kneepkins et al., 1986), *Tragulus*, and *Choeropsis* (Fishser et al., 2007). As in Hyracoidea, the muscle inserts on the fascia over mm. infraspinatus and supraspinatus and onto the tuber spinae (Campbell, 1936; Kneepkins et al., 1989).

In *Cynocephalus* and *Oryctolagus* m. acromiotrapezius is typical (Bensley, 1921; Diogo, 2009). In Rodentia m. acromiotrapezius is typical, but may insert on the clavicle (Young, 1937; Rinker, 1954; Woods, 1972; McEvoy, 1982; Ryan, 1989).

In Primates mm. acromiotrapezius and spinotrapezius are fused into a single sheet, the "trapezius." Its origin reaches the occiput in *Daubentonia*, (Soligo, 2005), *Eulemur* (Miller, 1932), some Platyrrhini for which the occipital origin is supposedly primitive (Campbell, 1937; Schön, 1968; Dunlap et al., 1985), and the Catarrhini (Dobson, 1881b; Primrose, 1899; Sonntag, 1922a; Patterson, 1942; Miller, 1952; Soligo, 2005; Standring et al., 2005); but in other primates it is lacking a cranial attachment (Murie & Mivart, 1872; Beddard, 1891; Woollard, 1925; Beattie, 1927; Miller, 1932; Campbell, 1937; Hill, 1959; Ashton & Oxnard, 1963; Soligo, 2005).

In Strepsirrhini trapezius inserts on the acromion and/or spine of the scapula (Owen, 1866; Murie & Mivart, 1872; Beddard, 1891; Woollard, 1925; Soligo, 2005). In some Platyrrhini (Campbell, 1937; Hill, 1959; Schön, 1968; Dunlap et al., 1985) and in the Catarrhini the insertion of trapezius extends to the clavicle (Dobson, 1881b; Primrose, 1899; Sonntag, 1922a; Patterson, 1942; Miller, 1952; Standring et al., 2005). In the brachiating Catarrhini, the occipital origin and clavicular insertion are much stronger. *Homo* has the most extensive clavicular insertion of all the apes (Miller, 1932).

Summary: M. acromiotrapezius with an attachment to the occiput is plesiomorphic in mammals, and is seen in *Orycteropus* and afrotheres. Xenarthrans and many genera of Laurasiatheria are lacking an occipital attachment. While m. acromiotrapezius inserts on the clavicle, acromion, and spine of the scapula in Monotremata and Marsupialia, a clavicular attachment is lacking in most eutherian mammals. This feature, however, may reflect differences in the development or differentiation of m. clavotrapezius. In most of Laurasiatheria and Hyracoidea m. acromiotrapezius is attached only to the spine of the scapula or the fascia near the spine of the scapula. *Orycteropus* and other afrotheres have m. acromiotrapezius attaching on the acromion and spine of the scapula, a configuration also shared by Erinaceidae, *Solenodon*, *Caenolestes*, and many Euarchontoglires.

Character 8. M. spinotrapezius

Absent (0), fused with m. acromiotrapezius (1), separated from m. acromiotrapezius by a small gap (2), separated from m. acromiotrapezius by a large gap (3)

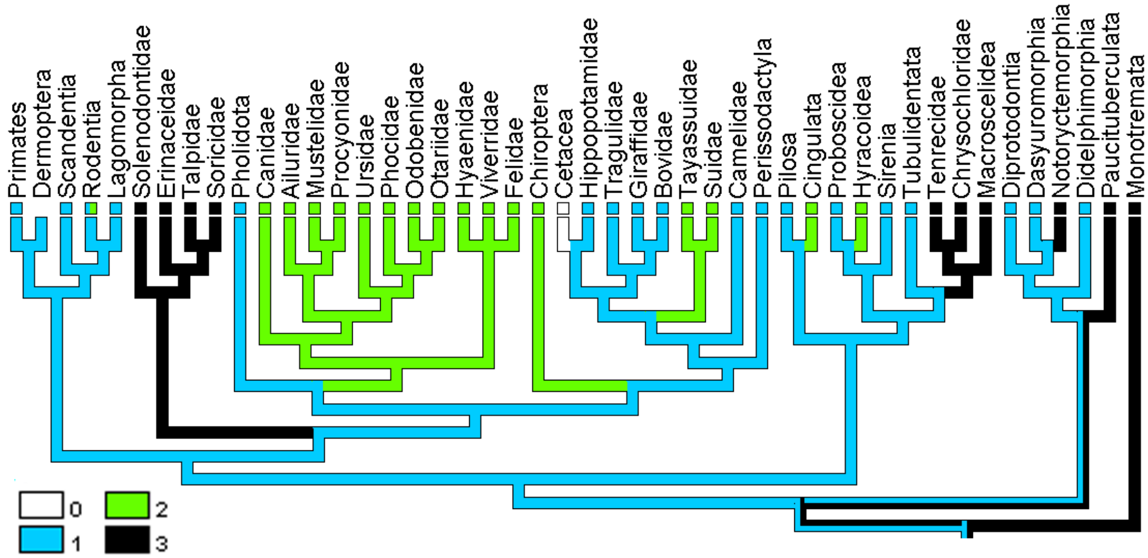


Figure 4.8. Phylogeny depicting character states of m. spinotrapezius.

M. spinotrapezius is the most caudal portion of the trapezius. There may be a large gap between the origins of mm. acromiotrapezius and spinotrapezius muscles, leading to the frequent use of the term “trapezius posterior” for m. spinotrapezius, or they may be closely applied or even fused together. The muscle typically originates from thoracolumbar fascia and the spinous processes of thoracic and lumbar vertebrae, the number of which can vary even within species and so is not considered here (see also

Asher et al., 2009, for a discussion of variation in vertebral count in tenrecids and procaviids). M. spinotrapezius inserts along the scapular spine, with the tuber spinae serving as the main area of attachment in many mammals. Although the Nomina Anatomica Veterinaria (2005) uses the term "trapezius pars thoracica" for this muscle, I have used m. spinotrapezius in order to be consistent with the terms m. clavotrapezius and m. acromiotrapezius for other muscles of the trapezius complex.

In Monotremata the posterior portion of the trapezius complex, presumably m. spinotrapezius, arises from many thoracic and perhaps the proximal lumbar vertebrae as well as several ribs. This muscle is well separated from the supposed m. acromiotrapezius and inserts on the vertebral border or spine of the scapula (Mivart, 1866; Coues, 1870; McKay, 1895; Allen, 1912; Walter, 1988).

Mm. acromiotrapezius and spinotrapezius are usually fused into a single sheet in Didelphimorphia (Coues, 1872; Sidebotham, 1885; Jenkins & Weijs, 1979; Stein, 1981), Dasyuromorphia (Macalister, 1870; Cunningham, 1882; MacCormick, 1886; Jones, 1949), and Diprotodontia (Macalister, 1870; Cunningham, 1882; Young, 1882; Parsons, 1896b; Sonntag, 1922b; Shrivastava, 1962a). However, mm. acromiotrapezius and spinotrapezius muscles are well separated in *Caenolestes* (Osgood, 1921) and *Notoryctes*.

M. spinotrapezius of *Notoryctes* may not be homologous with m. spinotrapezius of eutherian mammals, even though it has the typical attachments (Wilson, 1894; Warburton, 2003). The first issue is that the muscle is "supplied from the brachial plexus… by a nerve which also supplies the latissimus dorsi" (Wilson, 1894: 9). This sounds similar to m. dorsocutaneus of *Potamogale*, which also seems to share innervation with m. latissimus dorsi. The second issue is the distance separating it from the rest of the trapezius complex, because "among marsupials, the trapezius consistently arises as a single sheet along the mid-dorsal line… the separate origin of the spino-trapezius in *Notoryctes* is unique" (Warburton, 2003: 93). It is possible that the bifid m. acromiotrapezius is actually both mm. acromiotrapezius and spinotrapezius, and the supposed m. spinotrapezius is possibly m. dorsocutaneus.

In *Orycteropus*, *Elephas*, and Sirenia mm. acromiotrapezius and spinotrapezius are mostly fused together into a single sheet (Sonntag, 1925; Shindo & Mori, 1956b; Domning, 1978). In Hyracoidea (Murie & Mivart, 1865) and most tenrecs mm. acromiotrapezius and spinotrapezius are typical and separate; however, in Tenrecidae m. spinotrapezius does mingle somewhat with the caudal edge of m. acromiotrapezius (Dobson, 1883; Jullien, 1967), even being described as very connected into one sheet in *Micropotamogale* (Verheyen, 1961). This contrasts with Chrysochloridae and Macroscelidea, in which m. spinotrapezius is quite separate from m. acromiotrapezius (Dobson, 1883; Campbell, 1938; Jullien, 1967; Puttick & Jarvis, 1977; Gasc et al., 1986).

Mm. acromiotrapezius and spinotrapezius are fused into one sheet in Pilosa (Galton, 1869b; Humphry, 1869b; Macalister, 1869a), but the muscles are separate in Cingulata (Galton, 1869a; Macalister, 1875a; Miles, 1941).

M. spinotrapezius has a distal thoracic origin in Erinaceidae (Dobson, 1881a, 1882b; Parsons, 1898a; Jullien, 1967; Neveu & Gasc, 2002) and Solenodontidae (Dobson, 1882b; Allen, 1910), a thoracic and lumbar origin in Soricidae (Reed, 1951; Sharma, 1958; Gugler, 1959; Jullien, 1967; Neveu & Gasc, 2002), and a lumbar or iliac origin in the Talpidae (Dobson, 1883; Reed, 1951; Jullien, 1967; Whidden, 2000). M. acromiotrapezius and spinotrapezius thus originate very distantly from one another in most eulipotyphlans (Parsons, 1898a; Campbell, 1939; Reed, 1951; Sharma, 1958; Gugler, 1959; Jullien, 1967); however, in *Solenodon*, mm. acromiotrapezius and spinotrapezius are separated by only a small distance (Allen, 1910).

In Perissodactyla mm. acromiotrapezius and spinotrapezius are fused into one sheet (Murie, 1871; Sisson, 1914; Campbell, 1936). In the Suidae, m. spinotrapezius is separated from m. acromiotrapezius by an interval, which is not true of other artiodactyls in which the two muscles are fused into one sheet (Windle & Parsons, 1901).

In Carnivora there is only a slight separation between mm. acromiotrapezius and spinotrapezius at both origin and insertion (Devis, 1868; Humphry, 1868; Murie, 1872d; Allen, 1882; Ross, 1883; Watson & Young, 1879; Windle, 1888; Young & Robinson, 1889; Windle & Parsons, 1897; Beddard, 1900; Hall, 1926; Howell, 1929; Fisher, 1942; Davis, 1964; Getty, 1975; Leach, 1977; Gilbert, 1984; Spoor & Badoux, 1986a; Feeney, 1999; Fisher, 2009; Diogo et al., 2012a; Julik et al., 2012). In *Manis* m. acromiotrapezius is confluent with m. spinotrapezius (Humphry, 1869b; Macalister, 1875b).

In Scandentia and Primates mm. acromiotrapezius and spinotrapezius are mostly fused together, with typical attachments (Davis, 1938; Le Gros Clark, 1924, 1926; George, 1977). In Rodentia m. acromiotrapezius is generally continuous with m. spinotrapezius (Lewis, 1949; Wood & White, 1950; McEvoy, 1982), although it is further separated in the Myomorpha (Howell, 1932; Rinker, 1954; Stein, 1986). The muscles are probably fused into one sheet in *Oryctolagus* (Popesko et al., 1992), but this is unclear as two parts of trapezius are described (Bensley, 1921).

Summary: In Monotremata, Eulipotyphla, Afrosoricida, Macroscelidea, and *Caenolestes* m. spinotrapezius is well separated from m. acromiotrapezius. There is a small space between the two muscles in Cingulata, Chiroptera, Hyracoidea, Carnivora, and some Artiodactyla. In *Orycteropus* and many other mammals, m. spinotrapezius is fused with m. acromiotrapezius, presumably a derived condition for eutherians. The distance separating mm. acromiotrapezius and spinotrapezius may reflect functional differences in forelimb use rather than phylogeny. Small fossorial mammals such as *Talpa* and *Notoryctes* have well separated muscles, whereas larger digging mammals like *Orycteropus* and *Manis* show fusion of the two muscles.

Character 9. M. dorsocutaneus
Absent (0), present (1)

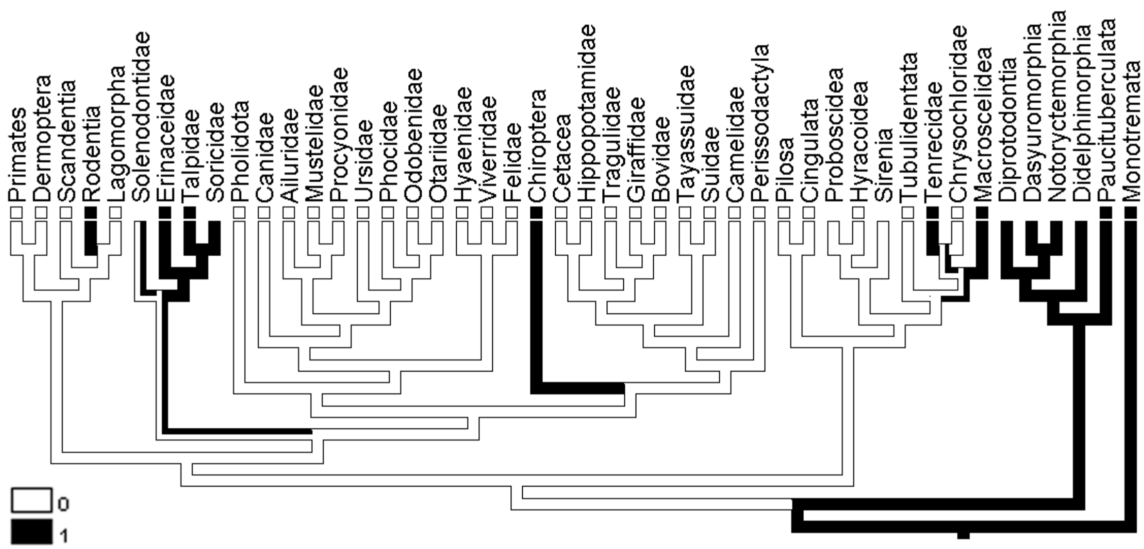


Figure 4.9. Phylogeny depicting character states of m. dorsocutaneus.

M. dorsocutaneus, or "trapezius subcutaneous," is a fragment of the trapezius complex whose distal insertion has emigrated to the skin. The muscle is often regarded as belonging to the cutaneous muscles of the trunk (m. panniculus carnosus), but is distinguished by its accessory nerve innervation and is not innervated by the anterior thoracic nerve (Michelsson, 1921; Jouffroy, 1971). The muscle is found in monotremes (Diogo & Abdala, 2010), and in *Caenolestes*, but not in any other marsupial (Osgood, 1921). M. dorsocutaneus is particularly developed in some fossorial mammals such as the Talpidae and the Geomyidae and is also found in Erinaceidae and Tenrecidae (Dobson, 1882b, 1883 - *Desmana*; Reed, 1951 - *Neurotrichus*; Sharma, 1958 - *Suncus*; Jouffroy, 1971). I suspect that the additional "intermediate" portion of trapezius seen in macroscelidids may be m. dorsocutaneus with a bony insertion.

M. dorsocutaneus is present in *Potamogale* and *Micropotamogale* (Verheyen, 1961). However, I traced the nerve for m. latissimus dorsi to m. dorsocutaneus in my specimen of *Potamogale*, thus it is unclear if this muscle is homologous.

In Macroscelidea an unusual intermediate portion of trapezius can be found between mm. acromiotrapezius and spinotrapezius, stretching between the distal ligamentum nuchae and the vertebral border of the scapula near the base of the scapular spine. While this intermediate trapezius is completely distinct from mm. acromiotrapezius and spinotrapezius in *Elephantulus* and *Macroscelides*, it is partially connected with m. acromiotrapezius in *Petrodromus* and *Rhynchocyon* (Jullien, 1967). This muscle may represent m. dorsocutaneus which has achieved a bony insertion, as it appears to share accessory nerve innervation in my specimens.

There is an extra muscle in the trapezius complex of many Talpidae described as the caudal-most fibers of m. acromiotrapezius sending a slip to the vertebral border of the scapula (Dobson, 1883; Reed, 1951; Whidden, 2000). Although it seems similar to the intermediate portion of trapezius in the Macroscelidea, Whidden (2000) considers this to be an unusual portion of m. acromiotrapezius. It co-exists with the "dorso-cuticularis" muscle, seemingly homologous with m. dorsocutaneus (Dobson, 1883; Whidden, 2000).

In Chiroptera a special muscle, "occipito-pollicalis," forms the leading margin of the wing (Vaughan, 1959; Norberg, 1972; Altenbach, 1979). This muscle may be derived from the trapezius complex (Jouffroy, 1971). It is probably not homologous with m. dorsocutaneus, but again the homology is uncertain.

In Rodentia an additional portion of trapezius, the auricular slip, is the primitive condition which has either remained unchanged, disappeared, or transformed into cheek pouch musculature often retaining accessory innervation (Klingener, 1970; Woods, 1972). The exact conformation of this additional muscle has been used in systematic studies of the rodents (Windle, 1887; Woods, 1972; Ryan, 1989; Thorington et al., 1997). It is unclear if this muscle is homologous with m. dorsocutaneus.

Summary: M. dorsocutaneus was scored as present for any groups in which an additional discreet muscle is associated with the trapezius complex, even though the homology is not certain. *Orycteropus* is lacking additional trapezius muscles. Interestingly, the groups with a possible m. dorsocutaneus also tend to have a large separation between mm. acromiotrapezius and spinotrapezius (character 8), so these two features may be related.

Possibility of six components of the trapezius complex

With all the confusion described above, it is possible that there are really six components of the trapezius complex, three ventral and three dorsal. Hill (1937) believes, for example, that m. acromiotrapezius of rodents, with its clavicular insertion, might be homologous with the fused mm. clavotrapezius and acromiotrapezius of other mammals. Yet rodents possess a "cleido-occipital" (which I have assumed is m. clavotrapezius), which would result in a total of six components if Hill (1937) is correct. Similarly, Diogo & Abdala (2010) suggested that the "cleido-occipitalis" of mammals probably corresponds to part of the reptilian trapezius, but the "cleido-occipitalis" (m. clavotrapezius) of carnivores may correspond to part of the reptilian mm. sterno-cleido-mastoideus. The strange conformation of the trapezius complex and the presence of m. dorsocutaneus in some afrotheres makes me suspect that this may be correct and primitively there are really six components of the trapezius complex. However, without detailed information regarding the embryological development, more specific innervations of the various parts of the trapezius complex, and the position of the great auricular nerve in all orders of mammals, it is difficult to determine whether a total of six components might have been present in primitive mammals. For now, I have considered the "cleido-occipital" of many authors to be the same as m. clavotrapezius, and any clavicular insertions of m. acromiotrapezius as just that. Clearly, however, the homologies of the components of the trapezius complex are not adequately resolved.

B. RHOMBOID GROUP – DORSAL SCAPULAR NERVE

Character 10. Rhomboideus capitis
Absent (0), present (1)

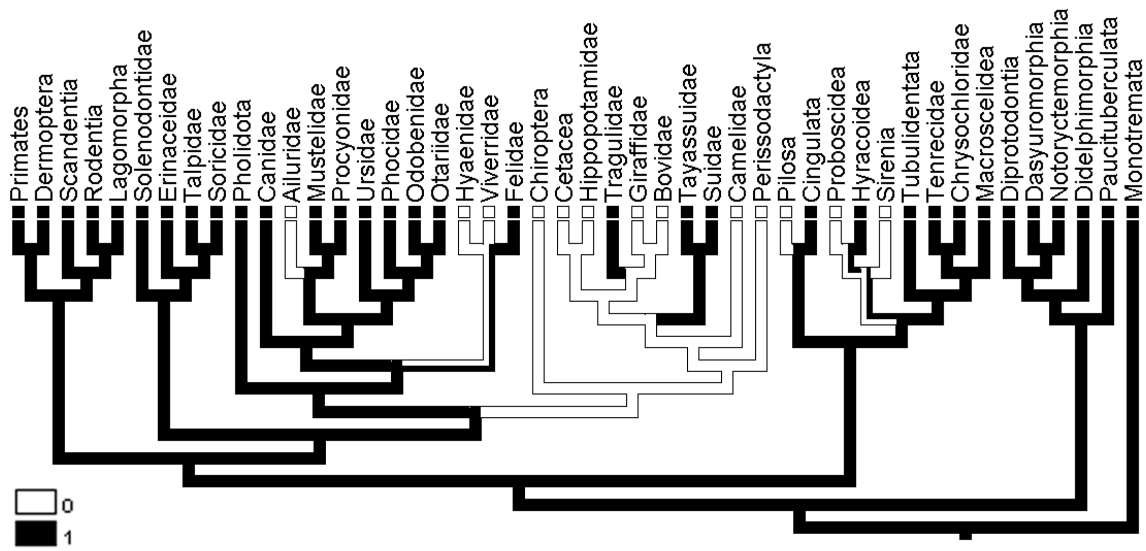


Figure 4.10. Phylogeny depicting character states of m. rhomboideus capitis.

Character 11. Rhomboideus cervicis
Absent or fused with rhomboideus capitis (0), origin occipital (1), cervical (2), thoracic (3)

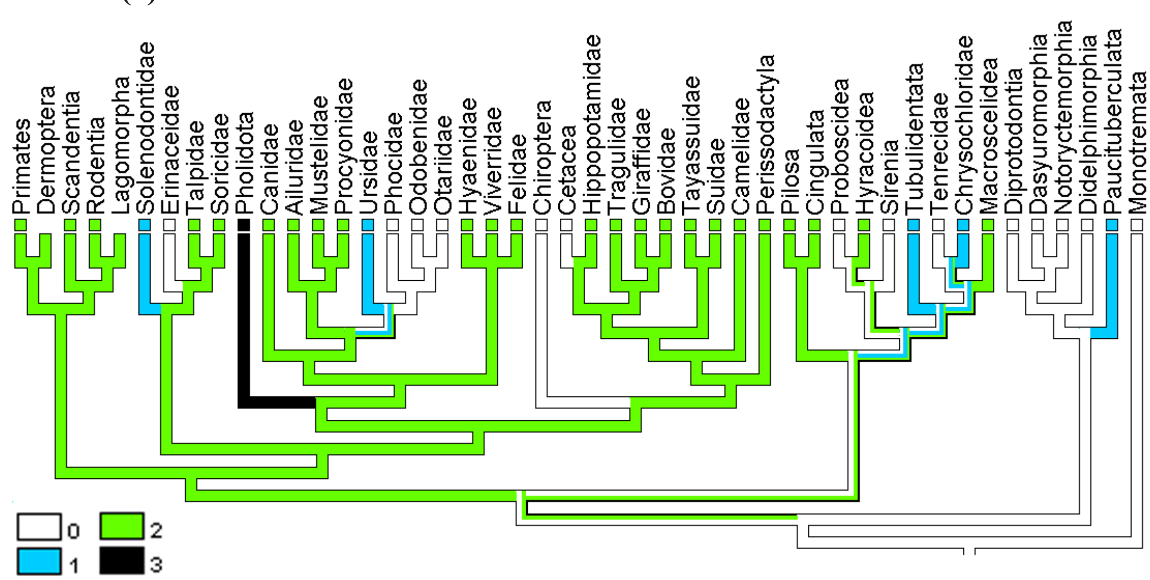


Figure 4.11. Phylogeny depicting character states of m. rhomboideus cervicis.

Character 12. Rhomboideus thoracis

Absent or fused with rhomboideus cervicis (0), origin thoracic (1)

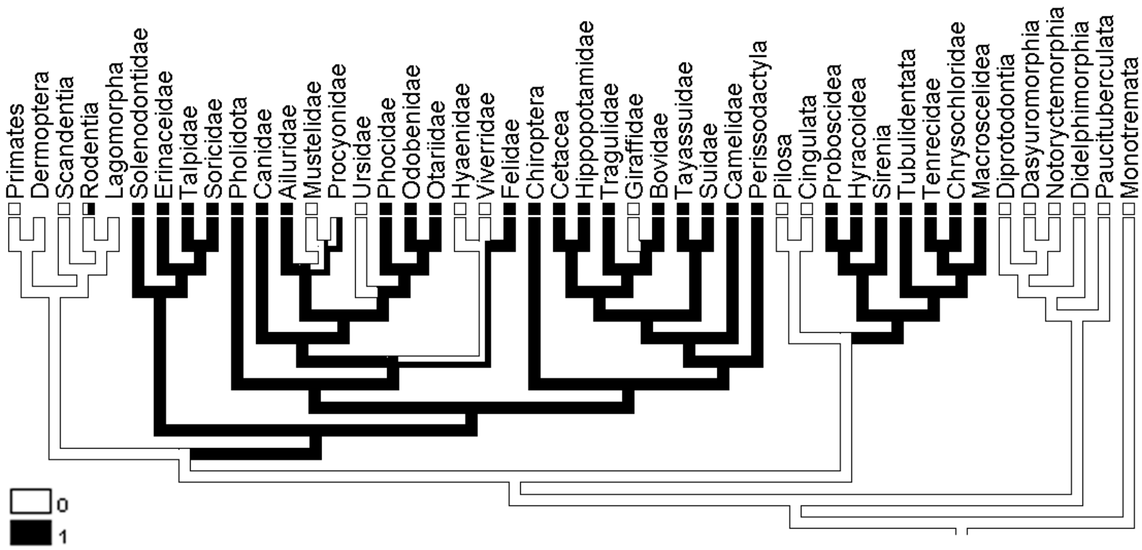


Figure 4.12. Phylogeny depicting character states of m. rhomboideus thoracis.

M. rhomboideus is undivided in monotremes and has an origin from the cranium and cervical vertebrae and inserts on the vertebral border of the scapula (Mivart, 1866; Coues, 1870; Allen, 1912; Howell, 1936; Walter, 1988). In most marsupials, the origin of the single muscle extends distally onto thoracic vertebrae but is otherwise unchanged from the monotreme condition (Macalister, 1870; Coues, 1872; Cunningham, 1882; Young, 1882; Sidebotham, 1885; MacCormick, 1886; Wilson, 1894; Parsons, 1896b; Sonntag, 1922b; Jones, 1949; Jenkins & Weijs, 1979; Stein, 1981; Warburton, 2003; Harvey & Warburton, 2010; Warburton, 2011). In Paucituberculata, however, there is a partial division into two mm. rhomboideus, both retaining cranial attachments (Osgood, 1921). Thus an undivided m. rhomboideus is primitive for mammals. A single undivided m. rhomboideus has been scored as the presence of m. rhomboideus capitis.

Within eutherian mammals there is much more differentiation and variation of m. rhomboideus, with the parts named according to their level of origin. M. rhomboideus capitis[3] attaches on the occiput and inserts near the cranial angle of the scapula. M. rhomboideus cervicis[4] typically originates from the ligamentum nuchae, although sometimes from the occiput, and inserts on the cranial end of the vertebral border of the scapula. M. rhomboideus thoracis[5] is similar but originates from thoracic vertebrae and inserts on the caudal end of the vertebral border of the scapula (Jouffroy, 1971). However, as in human anatomy, the demarcation between portions is not always clear, and the divisions noted in the literature may be merely based on grouping muscle fibers based on their location of origin rather than clear independence. For example, a muscle which is made up of mm. rhomboideus capitis et cervicis is often called m. rhomboideus anterior, but sometimes this term is used only for m. rhomboideus cervicis (Jouffroy, 1971). General region of attachment was scored for each portion of m. rhomboideus.

Homologies were an issue for *Orycteropus*, and I was unable to determine innervation. Some authors have called a muscle originating from the proximal cervical vertebrae in *Orycteropus* "occipitoscapular," a common synonym for m. rhomboideus capitis (Galton, 1870; Sonntag, 1925). However, it is possible that this muscle, which inserts on the superficial surface of the scapula near the cranial angle, instead represents a dorsal portion of m. omotransversarius as seen in *Calcochloris*. If it is associated with mm. rhomboideus, it should receive innervation from C5, and if it is m. omotransversarius it should receive innervation from C2-C4, the cervical plexus (Jouffroy, 1971). Here I consider the muscle in question m. rhomboideus capitis and

[3] occipitoscapular, rhomboideus occipitalis
[4] rhomboid minor, rhomboideus anticus
[5] rhomboid major, rhomboideus posticus

hope to resolve this pending investigation of a Frankfurt zoo specimen with Dr. Thomas Lehmann. *Orycteropus* also has m. rhomboideus cervicis originating from the occiput and cervical vertebrae (Humphry, 1868; Galton, 1870; Sonntag, 1925; Thewissen & Badoux, 1986), and m. rhomboideus thoracis originating from the proximal thoracic vertebrae (Galton, 1870).

The Tenrecidae have two inconsistently divided mm. rhomboideus; either mm. rhomboideus capitis et cervicis and m. rhomboideus thoracis or m. rhomboideus capitis and mm. rhomboideus cervicis et thoracis. However, the muscle sheet is single in *Potamogale* (Dobson, 1882a, 1883; Jullien, 1967; Neveu & Gasc, 2002). In Chrysochloridae, both mm. rhomboideus capitis and rhomboideus cervicis attach to the occiput (Dobson, 1883; Campbell, 1938; Gasc et al., 1986; Jullien, 1967), although the two muscles seemed to be fused in *Calcochloris*. There is also a small m. rhomboideus thoracis, which is described as originating from its partner via a dorsal raphe (Dobson, 1883; Parsons, 1901; Campbell, 1938; Jullien, 1967; Gasc et al., 1986), although I observed only a typical thoracic vertebrae origin in *Calcochloris*.

The Macroscelidea and Hyracoidea each have three identifiable portions of mm. rhomboideus, although there are not clearly defined borders between them (Murie & Mivart, 1865; Jullien, 1967). Information for the Proboscidea is limited and contradictory, but according to Jouffroy (1971) m. rhomboideus capitis is well separated from a single dorsal portion, m. rhomboideus thoracis. The Sirenia have only a single muscle, m. rhomboideus thoracis (Domning, 1977, 1978).

Xenarthrans in order Pilosa have only m. rhomboideus cervicis et thoracis (Galton, 1869b; Humphry, 1869b; Macalister, 1869a). Members of order Cingulata also have m. rhomboideus capitis (Galton, 1869a; Murie, 1872b; Miles, 1941).

Within Eulipotyphla, the three mm. rhomboideus are well defined (Jouffroy, 1971). Erinaceomorpha have a fused m. rhomboideus capitis et cervicis in addition to m. rhomboideus thoracis (Dobson, 1881a, 1882b; Parsons, 1898a; Neveu & Gasc, 2002). This is also the case in *Crocidura* (Jullien, 1967; Neveu & Gasc, 2002), but three differentiated mm. rhomboideus are found in other Soricomorpha (Dobson, 1882b, 1883; Allen, 1910; Reed, 1951; Sharma, 1958; Gugler, 1959; Jullien, 1967; Whidden, 2000). In the Talpidae, m. rhomboideus thoracis originates from its opposite partner, spanning the vertebral column and forming a dorsal raphe (Dobson 1882b, 1883; Reed, 1951; Whidden, 2000). This is also noted in the Chrysochloridae (Dobson, 1883; Campbell, 1938; Gasc et al., 1986), and is presumably a fossorial adaptation.

Within Artiodactyla, m. rhomboideus capitis is found only in Suina and in my specimen of *Tragulus* (Sisson, 1914; Campbell, 1936; Kneepkins et al., 1989). Other artiodactyls have only mm. rhomboideus cervicis and rhomboideus thoracis (Beddard, 1909; Sisson, 1914; Campbell, 1936; Getty, 1975; Smuts & Bezuidenhout, 1987), which are often fused (Murie, 1872c; Windle & Parsons, 1901; Fisher et al., 2007). The same situation is found in Perissodactyla (Murie, 1871; Beddard & Treves, 1889; Windle & Parsons, 1901; Sisson, 1914; Campbell, 1936). There is only m. rhomboideus thoracis in Cetacea (Murie, 1873b; Howell, 1927, 1930) and Chiroptera (Humphry, 1869a; Vaughan, 1959; Norberg, 1972; Altenbach, 1979; Hermanson & Altenbach, 1983).

In most carnivorans mm. rhomboideus capitis and rhomboideus cervicis et thoracis are present (Humphry, 1868; Murie, 1872d; Reighard & Jennings, 1901; Hall, 1926; Howell, 1929; Fisher, 1942; Leach, 1977). In Viverridae, Hyaenidae, Ailuridae, and possibly Procyonidae, m. rhomboideus capitis is absent (Devis, 1868; Watson & Young, 1879; Mivart, 1882; Young & Robinson, 1889; Beddard, 1900; Spoor & Badoux, 1986a; Fisher et al., 2009). Often there is a differentiated m. rhomboideus thoracis (Getty, 1975; Evans & Christensen, 1979; Feeney, 1999; Julik et al., 2012), as there is in *Manis* (Humphry, 1869b).

Within Rodentia, there is m. rhomboideus capitis and a variety of configurations of the one or two other portions of m. rhomboideus (Howell, 1932; Greene, 1935; Young, 1937; Wood & White, 1950; Rinker, 1954; Woods, 1972; McEvoy, 1982; Stein, 1986; Ryan, 1989; Thorington et al., 1997; Bezuidenhout & Evans, 2005). Scandentia have mm. rhomboideus capitis and rhomboideus thoracis which presumably also includes m. rhomboideus cervicis (Le Gros Clark, 1924, 1926). Most Primates have m. rhomboideus capitis and a combined rhomboideus cervicis et thoracis (Murie & Mivart, 1872; Dobson, 1881; Beattie, 1927; Patterson, 1942; Hill, 1959; Soligo, 2005). *Homo* is unusual within Primates as we lack m. rhomboideus capitis yet have individual mm. rhomboideus cervicis and rhomboideus thoracis (Standring et al., 2005), and there is only a single m. rhomboideus in the other Hominidae (Primrose, 1899; Miller, 1952).

Mm. rhomboideus and fossorial or aquatic adaptations

In *Orycteropus*, m. rhomboideus capitis inserts on the superficial surface of the scapula near the cranial angle (Galton, 1870; Sonntag, 1925). In *Calcochloris* and other golden moles, mm. rhomboideus capitis et cervicis also have an extensive insertion on the superficial surface of the scapula (Campbell, 1938; Jullien, 1967; Puttick & Jarvis, 1977). I observed a similar, though less extensive, insertion in *Potamogale* and *Microgale*, and it was also noted in *Micropotamogale* (Verheyen, 1961), but it is has not been reported in other Tenrecoidea. Thus, it seems *Orycteropus* may share this trait with Afrosoricida.

However, it is possible that the insertion of m. rhomboideus on the superficial surface of the scapula is an adaptation for digging or swimming. In Notoryctemorphia, the insertion of the single m. rhomboideus extends along the spine of the scapula (Wilson, 1894; Warburton, 2003). In *Manis*, m. rhomboideus capitis also inserts on the spine of the scapula (Humphry, 1869b), as does the muscle in the rodents *Castor* (Young, 1937), *Coendou* (McEvoy, 1982), *Spermophilus* (Thorington et al., 1997), and members of Cricetidae (Rinker, 1954). Notably, however, mm. rhomboideus in Talpidae insert only on the vertebral border of the scapula (Dobson, 1882b, 1883; Reed, 1951; Jullien, 1967; Whidden, 2000), and the absence of this attachment of m. rhomboideus capitis in the moles is puzzling if it is a fossorial adaptation. According to Kenneth D. Rose (personal communication), the highly modified and rod-like scapula of talpids might explain the lack of a rhomboideus attachment on the superficial surface of the bone.

Summary: As stated above, all conclusions regarding mm. rhomboideus are tentative for *Orycteropus* pending verification of muscle homologies. *Orycteropus* and many other eutherian mammals possess m. rhomboideus capitis, but the muscle tends to be lost in cursorial, aquatic, and flying mammals. The attachment of m. rhomboideus capitis on the superficial surface of the scapula may be a trait linking *Orycteropus* with the Afrosoricida. Very few mammals have an occipital attachment of m. rhomboideus cervicis, and this is a trait *Orycteropus* shares with chrysochlorids, *Caenolestes*, *Solenodon*, and *Ailuropoda*. This feature may have functional significance in these diverse mammals, but it is potentially a feature uniting Tubulidentata and Chrysochloridae. It should be noted that m. rhomboideus cervicis is quite variable in attachment within Afrotheria, perhaps further evidence that the homology here is uncertain. *Orycteropus* and the afrotheres, as well as many other eutherian mammals, have a typical m. rhomboideus thoracis.

C. OMO GROUP – CERVICAL NERVES, LONG THORACIC NERVE

Character 13. Number of portions of m. omotransversarius[6]
(0), (1), (2)

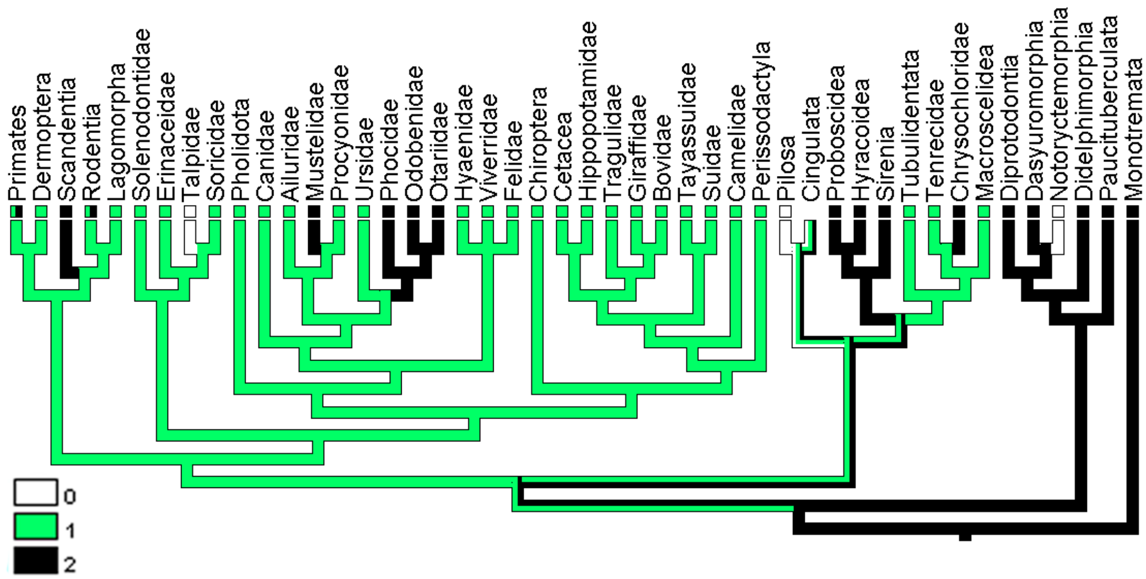


Figure 4.13. Phylogeny depicting character states of m. omotransversarius.

M. omotransversarius has received a myriad of names in the literature, some of which are sometimes also used for m. rhomboideus capitis or m. serratus ventralis cervicis. Due to the “imprécisions et confusions d'identification et de terminologie” (Jouffroy, 1971: 50), and to the absence of this muscle in humans, it seems to be mostly overlooked or even denied that there are two portions of this muscle in many mammals: “Quelques auteurs ont cru déceler au travers de ces variations l'existence de deux muscles non homologues... Rien dans l'innervation ou dans les autres rapports anatomiques ne

[6] acromio-basilar, acromio-trachelien, atlanto-acromialis, atlantoscapularis (anterior/posterior or inferior/superior or dorsalis/ventralis), cervico-humeral, levator claviculae, levator anguli scapulae, levator scapulae (anticus/posticus), levator scapulae vel claviculae, levator scapulae ventralis, masto-scapular, occipito-scapularis, omo-atlantic, omocervicalis, omo-cleido-transversarius, omo-trachelien

vient corroborer ce point de vue, cité pour mémoire. En particulier, il ne semble pas que la coexistence de deux formes ait jamais été signalée" (Jouffroy, 1971: 51). Here they are referred to as (1) the ventral portion of m. omotransversarius, which is found between mm. clavotrapezius and acromiotrapezius, often inserting in common with m. acromiotrapezius or around the acromion; and (2) the dorsal portion of m. omotransversarius, which typically inserts near the cranial angle of the scapula. Both portions originate from the atlas, rarely from the axis or other cervical vertebrae.

The derivation of the muscles is controversial. Most anatomists believe that m. omotransversarius was originally part of m. serratus ventralis cervicis, due to shared innervation by the proximal cervical nerves (Howell, 1932; Reed, 1951; Jouffroy, 1971; Diogo & Abdala, 2010). The most proximal fibers of m. serratus ventralis cervicis can appear to be a separate muscle, more so in mammals in which there is only a single m. omotransversarius (Woods, 1972). Others believe the muscle is derived from m. rhomboideus capitis (Cheng, 1955; Woods, 1972). Further study of this complicated muscle is needed, especially given the plethora of terms utilized in the literature.

Two portions of m. omotransversarius are found in *Tachyglossus*, one inserting at the acromion and the other near the cranial angle of the scapula (Mivart, 1866; Walter, 1988). Two portions of m. omotransversarius are also found in the Marsupialia (Coues, 1872; Cunningham, 1882; Sidebotham, 1885; MacCormick, 1886; Parsons, 1896b; Osgood, 1921; Sonntag, 1922b; Jenkins & Weijs, 1979; Stein, 1981; Harvey & Warburton, 2010; Warburton, 2011). M. omotransversarius is absent in the marsupial mole *Notoryctes* (Warburton, 2003).

As stated earlier in the discussion of m. rhomboideus capitis, *Orycteropus* may have two portions of m. omotransversarius, although it seems most likely that the portion inserting near the cranial angle of the scapula is actually m. rhomboideus capitis. Thus, *Orycteropus* probably has only the ventral portion of m. omotransversarius (Humphry, 1868; Galton, 1870; Sonntag, 1925; Thewissen & Badoux, 1986), as in the Tenrecoidea and Macroscelidea (Dobson, 1882a; Verheyen, 1961; Jullien, 1967; Neveu & Gasc, 2002). In contrast, chrysochlorids all have two portions of m. omotransversarius, both inserting on the acromion or metacromion (Dobson, 1883; Campbell, 1938; Jullien, 1967; Puttick & Jarvis, 1977; Gasc et al., 1986).

It seems there are also two portions of m. omotransversarius in Hyracoidea, Proboscidea, and Sirenia, but no other author has recognized the second muscle as such (Murie & Mivart, 1865; Murie, 1872a, 1885; Miall & Greenwood, 1878b; Anderson, 1883; Shindo & Mori, 1956b; Domning, 1977, 1978). However, the positional relationship of the two muscles relative to the trapezius complex is clear to me, and I reject the myriad other names applied to the muscles in the paenungulates (third portion of masto-humeral, cephalobrachialis, brachiocephalicus, levator scapulae, separate slip of trapezius anterior, levator claviculae, most forward portion of levator anguli scapulae, third part of sterno-cleido-mastoid). In these orders, one muscle originates from the atlas or skull base and inserts on the fascia over m. infraspinatus or the cranial angle of the scapula, and the other originates from the atlas or mastoid process to insert at the clavicular intersection. These two muscles in the paenungulates are especially deserving of additional study.

M. omotransversarius is absent in Pilosa (Galton, 1869b; Humphry, 1869b; Macalister, 1869a), but a muscle from the skull to the metacromion, which may be m. omotransversarius, is found in two Cingulata species (Galton, 1869a; Murie, 1872a).

Within Eulipotyphla, generally there is only a single m. omotransversarius (Dobson, 1882; Allen, 1910; Reed, 1951; Sharma, 1958; Jullien, 1967; Neveu & Gasc, 2002). Among Erinaceidae, there may be two portions of m. omotransversarius in *Echinosorex*, but again only one is recognized in the literature (Dobson, 1881a; Parsons, 1898a; Neveu & Gasc, 2002). In Soricidae, there are two portions in *Cryptotis* (Gugler, 1959). Most Talpidae have no m. omotransversarius (Dobson, 1883; Reed, 1951; Jullien, 1967; Whidden, 2000), but there are reports of one or even two portions in *Desmana*, *Galemys*, *Condylura*, and *Uropsilus* (Dobson, 1882b, 1883; Whidden, 2000).

Chiropterans have a single m. omotransversarius, which inserts on the clavicle (Humphry, 1869a; Vaughan, 1959; Jouffroy, 1971; Norberg, 1972; Altenbach, 1979) or acromion (Vaughan, 1959; Hermanson & Altenbach, 1983). It may originate from the axis or third cervical vertebra (Humphry, 1869a; Hermanson & Altenback, 1983).

In Perissodactyla, there is a single m. omotransversarius, which inserts into the fascia of the scapula near the acromion in *Tapirus* (Windle & Parsons, 1901; Campbell, 1936), but becomes a part of the m. brachiocephalicus at the clavicular intersection in *Equus* and *Rhinoceros* (Windle & Parsons, 1901; Sisson, 1914; Jouffroy, 1971; Budras & Sack, 2012). This is similar to the situation seen in the Paenungulata. In *Equus*, the origin is from the proximal four cervical vertebrae (Windle & Parsons, 1901; Sisson, 1914), an unusual situation within Mammalia.

There is a single m. omotransversarius in most Carnivora, the ventral portion based on its insertion at the acromion (Devis, 1868; Watson & Young, 1879; Allen, 1882; Mivart, 1882; Kelley, 1888; Young & Robinson, 1889; Beddard, 1900; Reighard & Jennings, 1901; Davis, 1964; Getty, 1975; Spoor & Badoux, 1986a; Feeney, 1999; Fisher, 2009). However, among caniforms, "m. rhomboideus profundus" in the Mustelidae probably represents a second portion of m. omotransversarius (Hall, 1926; Fisher, 1942), and there are two portions in pinnipeds, one of which inserts on the proximal humerus in *Phoca* (Humphry, 1868; Howell, 1929). I suspect that the "masto-scapular" muscle from the mastoid process to the spine of the scapula in *Manis* (Humphry, 1869b) is a single m. omotransversarius.

Artiodactyla have a single m. omotransversarius which inserts on the fascia over the scapula (Windle & Parsons, 1901; Sisson, 1914; Campbell, 1936; Getty, 1975; Smuts & Bezuidenhout, 1987; Fisher et al., 2007). This is very similar to the ventral portion of m. omotransversarius in the Hyracoidea. In *Giraffa*, the muscle originates more caudally, from the last two cervical vertebrae (Windle & Parsons, 1901). There seems to be a single m. omotransversarius in Cetacea (Murie, 1873b; Howell, 1927, 1930).

Some rodents have only one m. omotransversarius (Parsons, 1898b; Greene, 1935; Young, 1937; Wood & White, 1950; Rinker, 1954; Stein, 1986; Ryan, 1989), but many have two portions (Howell, 1932; Woods, 1972; McEvoy, 1982; Thorington et al., 1997; Bezuidenhout & Evans, 2005). McEvoy (1982) found a great deal of variation in the insertion of this muscle in the Erethizontidae.

There are probably two portions of m. omotransversarius in the Scandentia (Le Gros Clark, 1926; George, 1977; Diogo & Abdala, 2010). Primates and Dermoptera have only one m. omotransversarius which can have attachment onto the clavicle as well as the acromion and spine of the scapula (Murie & Mivart, 1872; Dobson, 1881b; Primrose, 1899; Sonntag, 1922a; Woollard, 1925; Beattie, 1927; Patterson, 1942; Miller, 1952; Hill, 1959; Soligo, 2005; Diogo & Abdala, 2010). However, there are supposedly two portions in *Alouatta* (Schön, 1968) and *Chlorocebus* (Dobson, 1881b), whereas the muscle is absent in humans (Standring et al., 2005).

M. omotransversarius and fossorial or aquatic adaptations

Interestingly, m. omotransversarius is absent in the marsupial mole *Notoryctes* (Warburton, 2003), in most talpids (Dobson, 1883; Reed, 1951; Jullien, 1967; Whidden, 2000), in the burrowing squirrels (Thorington et al., 1997), and in *Dasypus* (Miles, 1941), yet it is a double muscle in Chrysochloridae. There is probably a single m. omotransversarius in cetaceans and in the semi-aquatic afrothere *Potamogale*, but the muscle is doubled in the pinnipeds. Thus, m. omotransversarius does not seem to reflect locomotor adaptations and should be a very useful character for phylogenetic analysis.

Summary: M. omotransversarius is doubled in the more basal groups of mammals, thus a single m. omotransversarius is evidently derived. *Orycteropus* shares this derived single m. omotransversarius with Tenrecidae and Macroscelidea and most of Laurasiatheria, but not with other afrotheres. The paenungulates and Chrysochloridae share the primitive doubled m. omotransversarius with Monotremata, Marsupialia, and Euarchontoglires.

Character 14. M. omohyoideus
Absent (0), present (1), unusual insertion (2)

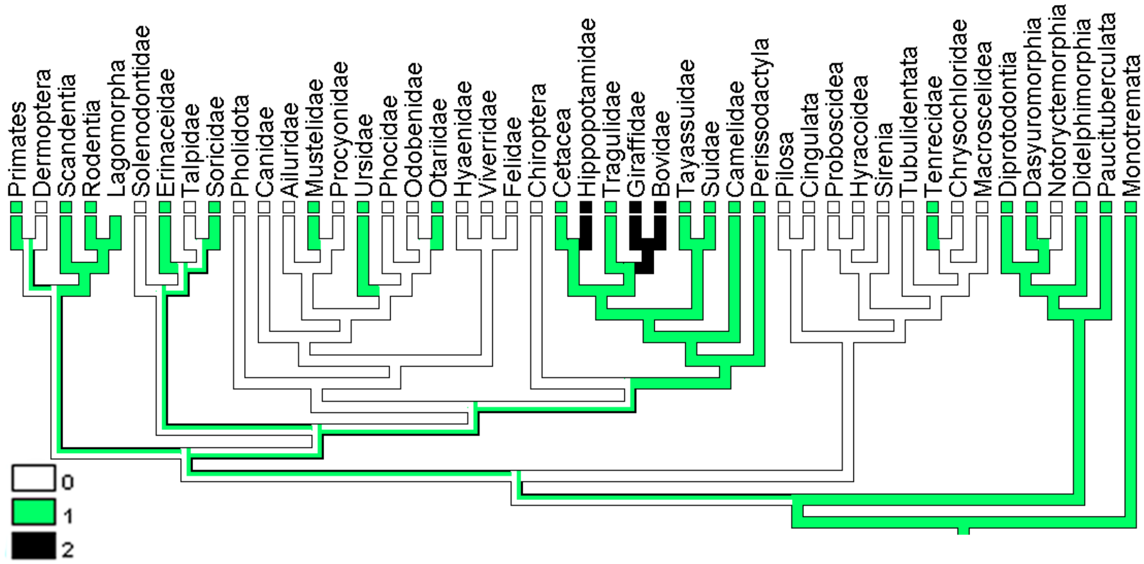


Figure 4.14. Phylogeny depicting character states of m. omohyoideus.

M. omohyoideus shows very little variation in attachments within mammals; usually it extends from the hyoid to the cranial border of the scapula. However, m. omohyoideus may have an unusual insertion and it is not always present.

It is present in the Monotremata (Mivart, 1866; Coues, 1870; Mckay, 1895; Allen, 1912), and in all orders of marsupials (Sonntag, 1921) except Notoryctemorphia (Wilson, 1894; Warburton, 2003).

It is absent in *Orycteropus* and in afrotheres except the Tenrecidae (Dobson, 1883; Verheyen, 1961). It is also absent in Xenarthra (Galton, 1869a, 1869b; Humphry, 1869b; Macalister, 1869a, 1873), and there is no mention of m. omohyoideus in any description of Chiroptera (Humphry, 1869a; Vaughan, 1959; Norberg, 1972; Altenbach, 1979; Hermanson & Altenbach, 1983).

Within Eulipotyphla m. omohyoideus is present in Erinaceidae (Dobson, 1881a, 1882b; Parsons, 1898a; Neveu & Gasc, 2002), and among Soricidae only in *Cryptotis* (Gugler, 1959). It is absent in Solenodontidae (Dobson, 1882b) and Talpidae (Dobson, 1883; Whidden, 2000).

M. omohyoideus is present in *Equus* and *Tapirus* (Windle & Parsons, 1901; Sisson, 1914; Budras & Sack, 2012). Within Carnivora, m. omohyoideus is present in Ursidae (Kelley, 1888; Davis, 1964), Mustelidae (Hall, 1926; Fisher, 1942), and Otariidae (Howell, 1929). M. omohyoideus is absent in *Manis* (Humphry, 1869b).

Within Artiodactyla, m. omohyoideus is present and with typical attachments in *Camelus* (Smuts & Bezuidenhout, 1987), Suina (Windle & Parsons, 1901), and *Tragulus* (Windle & Parsons, 1901); but it has an unusual insertion on the cervical vertebrae or carotid sheath in other ruminants (Owen, 1838; Windle & Parsons, 1901; Sisson, 1914; Getty, 1975). Among Cetacea, m. omohyoideus is present in *Balaenoptera* (Carte & Macalister, 1868) but absent in *Globicephala* (Murie, 1873b) and *Neophocaena* (Howell, 1927).

Within Rodentia, m. omohyoideus is absent in Anomaluromorpha (Parsons, 1898b), and Hystricomorpha (Wood & White, 1950; Woods, 1972), but present in Castorimorpha (Howell, 1932; Young, 1937; Ryan, 1989), Myomorpha (Howell, 1932; Greene, 1935; Rinker, 1954), and Sciuromorpha (Thorington et al., 1997; Bezuidenhout & Evans, 2005). M. omohyoideus is absent in the dermopteran *Cynocephalus* (Diogo, 2009), but present in Scandentia (Le Gros Clark, 1924, 1926; George, 1977) and in Primates (Owen, 1866; Murie & Mivart, 1872; Dobson, 1881b; Primrose, 1899; Sonntag, 1922a; Woollard, 1925; Beattie, 1927; Miller, 1952; Hill, 1959; Schön, 1968; Soligo, 2005; Standring et al., 2005).

Summary: The absence of m. omohyoideus in *Orycteropus* is a derived trait. *Orycteropus* shares this derived trait with Afrotheria except Tenrecidae and with orders Xenarthra, Dermoptera, Chiroptera, Pholidota, some Carnivora, Solenodontidae, Talpidae, and some Soricidae. It is possible that the muscle is not functionally relevant in fossorial or flying/gliding mammals. The absence of m. omohyoideus is inconsistent in the members of the former Lipotyphla and thus its presence in Tenrecidae and absence in Chrysochloridae would not be unusual for that grouping.

D. DELTOID GROUP – AXILLARY NERVE

Character 15. M. acromiodeltoideus
Reduced or absent (0), m. acromiodeltoideus fused with m. clavodeltoideus at origin (1), m. acromiodeltoideus has a discreet origin (2), m. acromiodeltoideus fused with m. spinodeltoideus at origin (3)

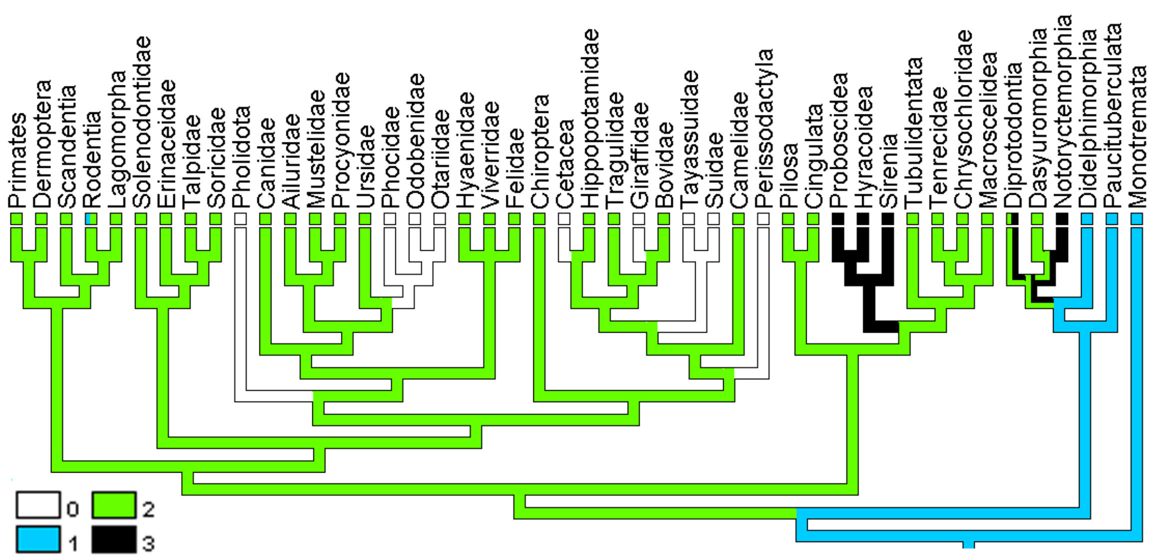


Figure 4.15. Phylogeny depicting character states of m. acromiodeltoideus.

Mm. deltoideus is generally made up of three components: m. clavodeltoideus, originating from the clavicle, m. acromiodeltoideus, originating from the acromion, and m. spinodeltoideus, originating from the spine of the scapula (Jouffroy, 1971). The portions can be modified in mammals lacking a clavicle or a strong acromion process, but they should be easily identified by locating the prominent axillary nerve in its consistent location in the quadrangular space and tracing the nerve branches into each part of mm. deltoideus. The three portions typically insert together on the deltoid crest of the humerus, lateral to the insertions of mm. pectoralis on the pectoral crest of the humerus.

There are only two portions of mm. deltoideus in the Monotremata, one from the spine of the scapula, and "acromioclavicularis." Its attachments and structure indicate how easily "acromioclavicularis" could split to become the acromial and clavicular heads found in other mammals (Shrivastava, 1962b). Other authors have confused "acromioclavicularis" with a fused mm. pectoralis superficialis and clavodeltoideus, based on homologues with reptiles and a partial innervation by the suprascapular ("supracoracoideus") nerve (Cuvier & Laurillard, 1850; Coues, 1871). However, the bulk of the muscle is innervated by the axillary nerve, and in mammals m. pectoralis superficialis is never innervated by the suprascapular nerve (Cheng, 1955).

In the Didelphimorphia and *Caenolestes*, mm. deltoideus are quite similar to those of the Monotremata, with one head from the acromion and clavicle and another from the spine of the scapula (Sidebotham, 1885; Osgood, 1921; Stein, 1981). In *Notoryctes*, there are also two heads of deltoideus, but the situation is different as there is a distinct clavicular head and the other head originates from the acromion and spine of the scapula (Wilson, 1894; Warburton, 2003).

In dasyuromorphs except *Thylacinus*, there are three separated portions of mm. deltoideus (Cunningham, 1882; MacCormick, 1886; Jones, 1949). Mm. deltoideus also has three portions in some Macropodidae (Harvey & Warburton, 2010; Warburton, 2011). There is a tendency for fusion of mm. acromiodeltoideus and spinodeltoideus or of all three portions in other diprotodonts (Cunningham, 1882; Young, 1882; Parsons, 1896b; Sonntag, 1922b; Hopwood, 1974). An especially interesting feature of these two groups is that the most cranial fibers of m. acromiotrapezius are continuous with mm. clavodeltoideus or acromiodeltoideus, forming the "marsupial trapezius" as was discussed above with the trapezius complex (Wilson, 1894; Shrivastava, 1962a).

In *Orycteropus* and macroscelidids, the three typical portions of mm. deltoideus are distinct (Humphry, 1868; Galton, 1870; Sonntag, 1925; Jullien, 1967). *Tenrec* and *Microgale* also have three portions (Neveu & Gasc, 2002). In *Potamogale*, mm. deltoideus has been confused with portions of the trapezius complex, thus the literature is unreliable. My interpretation of the myology indicates that the three typical portions are present but have undergone fusion with the elements of the trapezius complex (see chapter 3 for more detail).

In the Chrysochloridae, only two portions of mm. deltoideus have been described, one with an origin spanning both clavicle and acromion, presumably a conjoined mm. clavodeltoideus and acromiodeltoideus, and one from the spine of the scapula, m. spinodeltoideus (Parsons, 1901; Campbell, 1938; Jullien, 1967; Puttick & Jarvis, 1977; Gasc et al., 1986). However, I observed a definite separation between the origins of mm. clavodeltoideus and acromiodeltoideus in my specimen of *Calcochloris*, though the two portions are closely situated. Thus, at least in *Calcochloris*, the three typical portions of mm. deltoideus are present.

In the Hyracoidea, m. acromiodeltoideus is quite reduced in *Heterohyrax* and seems to be inconsistently absent in *Procavia* (Murie & Mivart, 1865; Windle & Parsons, 1901). In my hyrax specimens m. acromiodeltoideus seemed to be merged with m. spinodeltoideus, which had the typical origin from the spine of the scapula. M. clavodeltoideus forms the distal part of m. brachiocephalicus.

Information is limited for Proboscidea, but it seems that mm. acromiodeltoideus and spinodeltoideus are fused, while m. clavodeltoideus forms the distal part of m. brachiocephalicus (Miall & Greenwood, 1878a; Shindo & Mori, 1956a). In Sirenia, m. clavodeltoideus is present but mm. acromiodeltoideus and spinodeltoideus are fused (Domning, 1977, 1978). Thus, mm. acromiodeltoideus and spinodeltoideus tend to fusion in the Paenungulata.

Descriptions are unclear for Xenarthra, but m. acromiodeltoideus seems to have a discreet origin in Cingulata (Galton, 1869a; Murie, 1872b; Macalister, 1875a; Miles, 1941) and *Cyclopes* (Galton, 1869b) but maybe not in the other Pilosa.

Within Eulipotyphla, the Erinaceidae and the Soricidae have the typical three portions of mm. deltoideus (Dobson, 1881a, 1882b; Parsons, 1898a; Reed, 1951; Sharma, 1958; Gugler, 1959; Jullien, 1967; Neveu & Gasc, 2002). In *Solenodon*, m. clavodeltoideus is not described and presumably absent (Dobson, 1882b; Allen, 1910). In the Talpidae, mm. clavodeltoideus and acromiodeltoideus originate together from the clavicle, but m. spinodeltoideus is typical (Reed, 1951; Jullien, 1967; Whidden, 2000). A clavicular origin of m. acromiodeltoideus is thus shared by the talpids and chrysochlorids, and rather than indicating relationship, is probably an adaptation for digging.

Chiropterans have the typical three portions of mm. deltoideus (Vaughan, 1959; Norberg, 1972; Altenbach, 1979; Hermanson & Altenbach, 1983).

In most Carnivora, all three portions of mm. deltoideus are present (Watson & Young, 1879; Allen, 1882; Reighard & Jennings, 1901; Hall, 1926; Fisher, 1942; Davis, 1964; Getty, 1975; Leach, 1977; Spoor & Badoux, 1986a; Feeney, 1999; Fisher et al., 2009; Julik et al., 2012). In the pinnipeds, however, m. acromiodeltoideus is reduced or absent (Humphry, 1868; Murie, 1872d; Howell, 1929). In *Manis*, m. acromiodeltoideus may be absent (Humphry, 1869b), and it is feebly developed or absent in the Perissodactyla (Murie, 1871; Windle & Parsons, 1901; Sisson, 1914; Campbell, 1936).

In Artiodactyla, again there is a tendency for m. acromiodeltoideus to be reduced or absent altogether (Windle & Parsons, 1901; Campbell, 1936). All three parts of the muscle are found in *Camelus* (Smuts & Bezuidenhout, 1987), however. Some authors believe m. acromiodeltoideus is absent in the Suina (Windle & Parsons, 1901; Sisson, 1914). However, in *Pecari*, there is a small group of muscle fibers running parallel to the spine of the scapula and nearly confluent with the supraspinatus and infraspinatus. I interpret this as m. acromiodeltoideus, with an origin altered due to the reduced acromion; however, it might instead be a slightly subdivided portion of mm. supraspinatus or infraspinatus, as described by others (Campbell, 1936; Kneepkins et al., 1989). M. acromiodeltoideus is present but not robust in *Tragulus*, and not mentioned for several other ruminants (Murie, 1872c; Windle & Parsons, 1901; Beddard, 1909). All three portions of mm. deltoideus are present in Bovidae and Hippopotamidae (Windle &

Parsons, 1901; Sisson, 1914; Campbell, 1936; Getty, 1975; Fisher et al., 2007). In Cetacea, there is a single or possibly double portion of mm. deltoideus originating from the fascia of infraspinatus, presumably mm. spinodeltoideus and acromiodeltoideus (Carte & Macalister, 1868; Murie, 1873b; Howell, 1927, 1930).

In Castorimorpha and Myomorpha, there is a portion of mm. deltoideus originating from the acromion and the clavicle, and m. spinodeltoideus is present as well (Greene, 1935; Young, 1937; Rinker, 1954; Stein, 1986; Ryan, 1989). The hystricomorphs *Proechimys* and Erethizontidae have all three portions of mm. deltoideus (Woods, 1972; McEvoy, 1982). Some Sciuromorpha have an unusual extra portion of mm. deltoideus originating from the clavicle, in addition to the three typical portions (Thorington et al., 1997).

In Scandentia, all three portions of mm. deltoideus are present but mm. acromiodeltoideus and clavodeltoideus are fused for insertion (George, 1977). Primates have the same tendency, especially in the Catarrhini (Murie & Mivart, 1872; Beattie, 1927; Patterson, 1942; Hill, 1959; Soligo, 2005). In the Hominidae, the three portions of mm. deltoideus are mostly fused together but retain the typical attachments (Primrose, 1899; Miller, 1952; Standring et al., 2005).

Summary: Monotremata and Marsupialia have an "acromioclavicularis," or mm. acromiodeltoideus and clavodeltoideus are fused. *Orycteropus*, like most eutherian mammals, has a discreet and separable m. acromiodeltoideus. The paenungulates show fusion of mm. acromiodeltoideus and spinodeltoideus, and the acromial attachment of deltoideus is lost in many Laurasiatheria.

Insertion of m. clavodeltoideus: not scored due to ambiguity of homology

M. clavodeltoideus extends between the clavicle and deltoid crest of the humerus in many mammals (Jouffroy, 1971). It is absent in cetaceans. In most aclaviculate mammals, m. clavodeltoideus forms the distal part of "m. brachiocephalicus," which has led to its inappropriate name "cleidobrachialis" in the Nomina Anatomica Veterinaria (2005). Except for the lack of a bony origin, the muscle remains essentially unchanged. Thus, I do not consider this an important feature of the clavodeltoideus. The patterns of components of m. brachiocephalicus were discussed with the trapezius complex.

The insertion of m. clavodeltoideus, however, varies among mammals. In *Orycteropus*, it extends to the forearm—an unusual arrangement—and inserts on the radius with m. biceps brachii (Galton, 1870; Humphry, 1868; Sonntag, 1925). It inserts on the ulna in conjunction with m. biceps brachii in the hyracoids (Murie & Mivart, 1865) and *Hyaena* (Young & Robinson, 1889; Spoor & Badoux, 1986a), and on the ulna with m. brachialis in Felidae (Reighard & Jennings, 1901; Julik et al., 2012). In the Sciuridae the extra portion of mm. deltoideus originating from the clavicle inserts on the ulna with m. biceps brachii, while the seemingly typical m. clavodeltoideus inserts on the deltoid crest of the humerus as usual (Thorington et al., 1997; Bezuidenhout & Evans, 2005). This is intriguing and could indicate that the muscle that has been identified as m. clavodeltoideus in all anatomical descriptions for *Orycteropus* and hyrax is not homologous with m. clavodeltoideus of other mammals. Regardless, this is a rare myological feature shared by Tubulidentata and Hyracoidea and a few carnivores and rodents.

Character 16. M. spinodeltoideus

Origin from spine of scapula (0), from fascia of infraspinatus (1), from vertebral border of scapula (2)

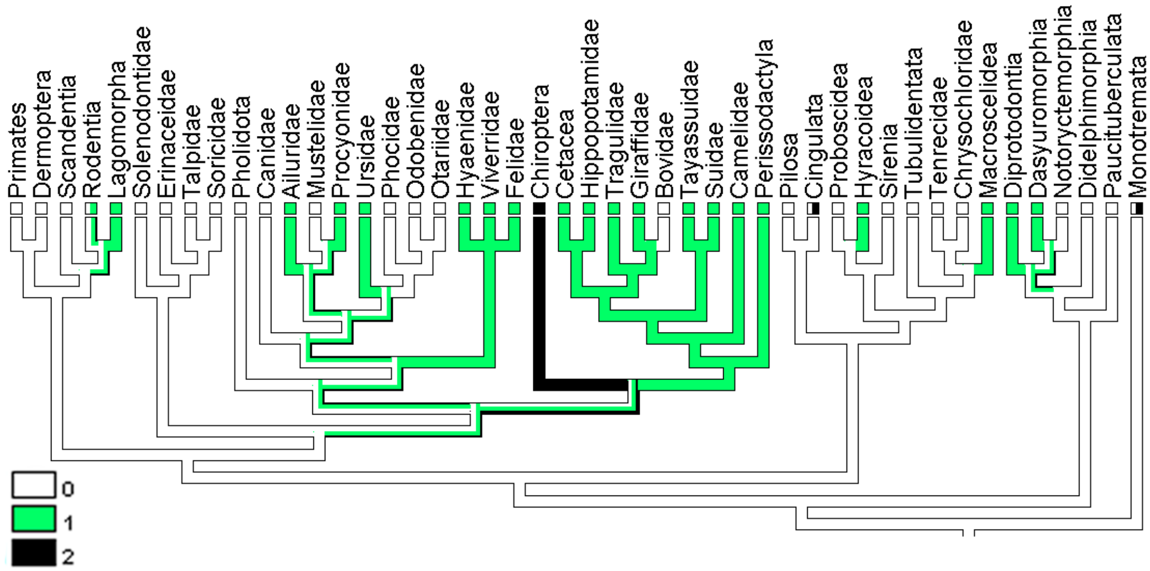


Figure 4.16. Phylogeny depicting character states of m. spinodeltoideus.

In *Orycteropus* and in most other mammals, m. spinodeltoideus takes origin from the spine of the scapula. M. spinodeltoideus has much less bony connection in many of the more cursorially adapted mammals, taking origin partially or fully from the fascia of m. infraspinatus (Jouffroy, 1971). This is seen in Macroscelididae (Jullien, 1967), Hyracoidea (Murie & Mivart, 1865; Windle & Parsons, 1901), Artiodactyla (Windle & Parsons, 1901; Beddard, 1909; Sisson, 1914; Campbell, 1936; Fisher et al., 2007), Perissodactyla (Murie, 1871; Windle & Parsons, 1901; Campbell, 1936), Carnivora except pinnipeds (Devis, 1868; Watson & Young, 1879; Allen, 1882; Young & Robinson, 1889; Davis, 1964; Spoor & Badoux, 1986a; Fisher et al., 2009; Julik et al., 2012), and many Rodentia (Greene, 1935; Wood & White, 1950; Rinker, 1954; McEvoy, 1982; Bezuidenhout & Evans, 2005). This is also observed in a few marsupials, which are not cursorially adapted: *Thylacinus*, Macropodidae, *Dasyurus*, and *Spilocuscus* (Cunningham, 1882; MacCormick, 1886; Harvey & Warburton, 2010; Warburton, 2011).

M. spinodeltoideus extends to the vertebral border of the scapula in some bats (Vaughan, 1959; Altenbach, 1979; Hermanson & Altenbach, 1983), *Dasypus* (Miles, 1941), and in one specimen of *Ornithorhynchus* (McKay, 1895). Presumably this attachment aids in extension, lateral rotation, and abduction of the shoulder joint related to flying in bats, and is possibly simple variation in the other two animals.

Summary: This character indicating the extent of the origin of m. spinodeltoideus may reflect functional anatomy rather than phylogeny. In *Orycteropus* and most mammals the muscle has its typical origin from the spine of the scapula. In cursorially adapted mammals and some others the muscle takes origin instead from the fascia of m. infraspinatus. In bats and in a few other rare cases the muscle originates from the vertebral border of the scapula.

Character 17. M. teres minor[7]
Fused with infraspinatus or absent (0), present and separate (1)

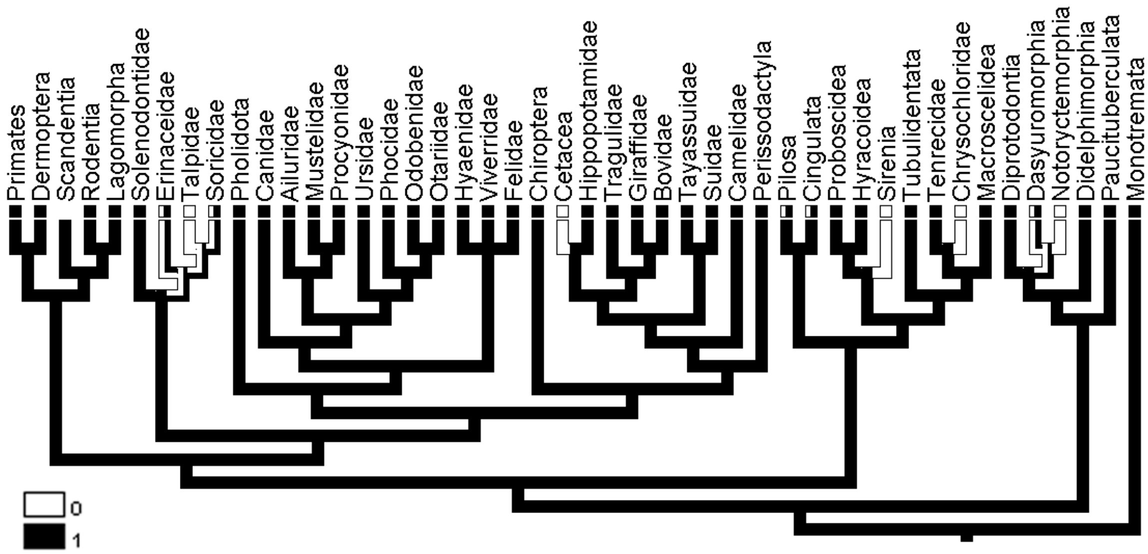


Figure 4.17. Phylogeny depicting character states of m. teres minor.

M. teres minor is found along the caudal border of the scapula and passes superficial to m. triceps brachii caput longum. It inserts on the greater tuberosity of the humerus just distal to the insertion of m. infraspinatus (Jouffroy, 1971).

I agree with Jullien (1967) that m. teres minor is often overlooked during anatomical description due to its small size and position in relation to the typically larger m. infraspinatus. Also, m. teres minor can be quite confounded with m. infraspinatus (Jouffroy, 1971). A branch of the axillary nerve will unfailingly lead the careful dissector to m. teres minor, even if the muscle has mostly fused with m. infraspinatus. This, for example, is the situation I observed in *Calcochloris*, whereas the muscle has been overlooked in all previous descriptions of Chrysochloridae. This is also the case in *Dasypus*, in which m. teres minor is "so fused with infraspinatus as to be indistinguishable except by its innervation" (Miles, 1941).

7 marginalis scapulae

There is disagreement in the literature over the presence or absence of m. teres minor in the Monotremata. Shrivastava (1962b) suggested that in monotremes m. teres minor has been frequently misidentified as m. infraspinatus (Mivart, 1866; Coues, 1870; Allen, 1912), which might be absent based on study of the innervation and development of the muscle (Cheng, 1955). However, Diogo & Abdala (2010) observed both mm. teres minor and infraspinatus in *Ornithorhynchus*.

Young (1882: 227) stated that "the absence of the teres minor as a distinct muscle appears to be general amongst marsupials," but this might not be the case. In Didelphimorphia, Paucituberculata, and Dasyuromorphia m. teres minor has been described as present (Cunningham, 1882; Sidebotham, 1885; MacCormick, 1886; Jones, 1949; Stein, 1981), absent (Coues, 1872; Cunningham, 1882), or not distinct from m. infraspinatus (Macalister, 1870; Osgood, 1921). Within the Diprotodontia, however, the muscle is consistently present and robust (Parsons, 1896b; Sonntag, 1922b; Hopwood, 1974; Harvey & Warburton, 2010; Warburton, 2011). The muscle is absent in Notoryctemorphia (Wilson, 1894; Warburton, 2003).

M. teres minor is found in *Orycteropus* and afrotheres, though much reduced in *Calcochloris*, *Potamogale*, and the Hyracoidea as per my dissections, and perhaps represented only by the tendon exposed on the caudal edge of m. infraspinatus in Sirenia (Domning, 1978).

M. teres minor is described as absent or rudimentary in some xenarthrans (Galton, 1869b; Macalister, 1869a; Murie, 1872b, Miles, 1941) and as an individual muscle in others (Galton, 1869a; Humphry, 1869b; Macalister, 1875a).

Within Eulipotyphla, m. teres minor is present in *Solenodon* (Allen, 1910), sometimes absent in Erinaceidae (Dobson, 1881a, 1882b), and seems to be usually absent in Soricidae (Reed, 1951; Sharma, 1958; Jullien, 1967; Neveu & Gasc, 2002) and Talpidae (Dobson, 1883; Reed, 1951; Jullien, 1967; Whidden, 2000).

M. teres minor is an individual muscle in Chiroptera (Humphry, 1869a; Vaughan, 1959; Norberg, 1972; Altenbach, 1979), Perissodactyla (Murie, 1871; Windle & Parsons, 1901; Sisson, 1914; Campbell, 1936), Artiodactyla (Murie, 1872c; Windle & Parsons, 1901; Beddard, 1909; Sisson, 1914; Campbell, 1936; Getty, 1975; Smuts & Bezuidenhout, 1987; Kneepkins et al., 1989; Fisher et al., 2007), and *Manis* (Humphry, 1869b). The muscle is also individual in the Carnivora although it is rather indistinct in the pinnipeds and *Procyon* (Humphry, 1868; Murie, 1872d; Watson & Young, 1879; Allen, 1882; Mivart, 1882; Young & Robinson, 1889; Reighard & Jennings, 1901; Hall, 1926; Howell, 1929; Davis, 1964; Getty, 1975; Leach, 1977; Spoor & Badoux, 1986a; Feeney, 1999; Fisher, 2009; Julik et al., 2012). M. teres minor is absent in Cetacea (Carte & Macalister, 1868; Murie, 1873b; Howell, 1927, 1930).

M. teres minor is described in many rodents (Howell, 1932; Greene, 1935; Wood & White, 1950; Rinker, 1954; Woods, 1972; McEvoy, 1982; Stein, 1986; Ryan, 1989; Thorington et al., 1997; Bezuidenhout & Evans, 2005).

It is unclear in much of the literature whether m. teres minor is present in Scandentia, or if this muscle is m. spinodeltoideus (Le Gros Clark, 1924, 1926; Davis, 1938; Endo, 1999; Diogo & Abdala, 2010). Detailed studies of the innervation suggest that it is m. spinodeltoideus, and m. teres minor is absent (George, 1977).

M. teres minor is present in Primates (Owen, 1866; Murie & Mivart, 1872; Beddard, 1891; Primrose, 1899; Sonntag, 1922a; Woollard, 1925; Beattie, 1927; Patterson, 1942; Miller, 1952; Hill, 1959; Schön, 1968; Soligo, 2005; Standring et al., 2005).

Summary: Distribution of this character indicates that the loss of m. teres minor or its fusion with m. infraspinatus has tended to occur in fossorial and aquatic mammals. *Orycteropus* and *Manis* do not share the tendancy for reduction in m. teres minor with other digging mammals.

Character 18. M. articularis humeri
(0) absent, (1) present

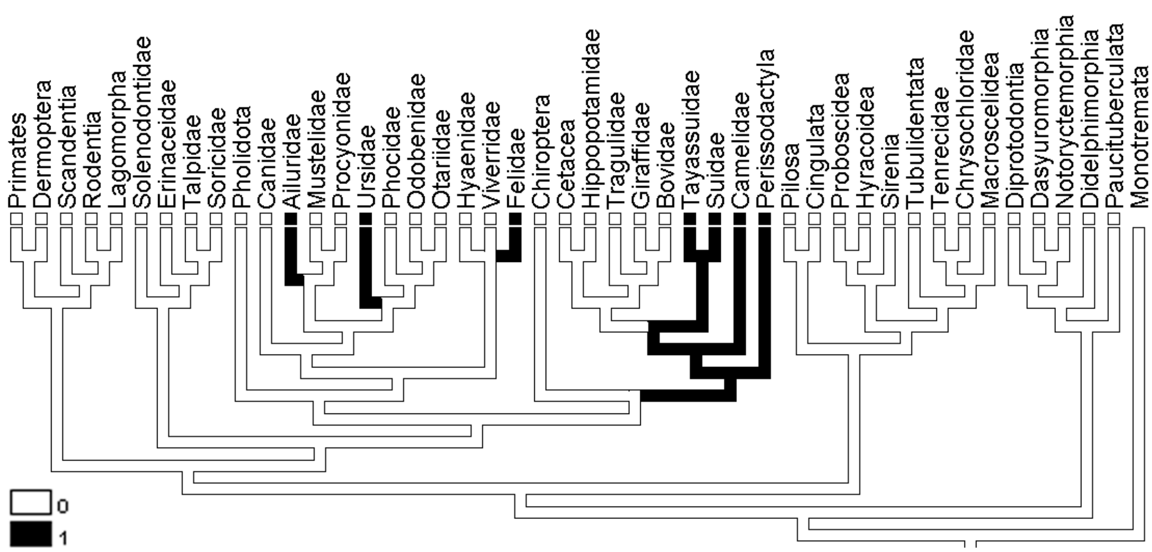


Figure 4.18. Phylogeny depicting presence of m. articularis humeri.

M. articularis humeri is found in a few, generally cursorial, mammals. It arises from the neck of the scapula and inserts on the gleno-humeral joint capsule or near it on the caudal surface of the humerus (Kjaersgaard, 1974). It is a separate muscle from m. teres minor, but may also be innervated by the axillary nerve (Windle & Parsons, 1901). An "accessory subscapularis" of uncertain homology is found in *Tachyglossus* (Walter, 1988), and this may be m. articularis humeri (Windle & Parsons, 1901). The muscle is definitely found in several Artiodactyla: *Sus* (Windle & Parsons, 1901; Sisson, 1914; Kjaersgaard, 1974), *Pecari*, *Babyrousa* (Kneepkins et al., 1989), and *Camelus* (Smuts & Bezeuidenhout, 1987); but it is absent in *Choeropsis* (Fisher et al., 2007). Within Perissodactyla it is seen in *Equus* (Windle & Parsons, 1901; Sisson, 1914), *Tapirus* (Bressou, 1961; Kjaersgaard, 1974), and *Rhinoceros* (Kjaersgaard, 1974). Windle & Parsons (1901) suggest m. articularis humeri is found in the elephant, but this is probably m. teres minor. M. articularis humeri has been described in the carnivores *Ursus* (Kjaersgaard, 1974), as well as *Felis* and *Ailurus* (Fisher, 2009; Julik et al., 2012). In the latter cases the muscle may actually be m. coracobrachialis, as it originates from the coracoid process, although innervation was not described.

Summary: M. articularis humeri is found only in Perissodactyla, basal Artiodactyla, and Carnivora. Its absence in *Orycteropus* and Hyracoidea does not provide support for Ungulata.

E. SUBSCAPULAR GROUP – SUBSCAPULAR NERVE

Character 19. M. subscapularis

Origin from superficial surface of the scapula (0), single origin from subscapular fossa (1), double origin from subscapular fossa (2)

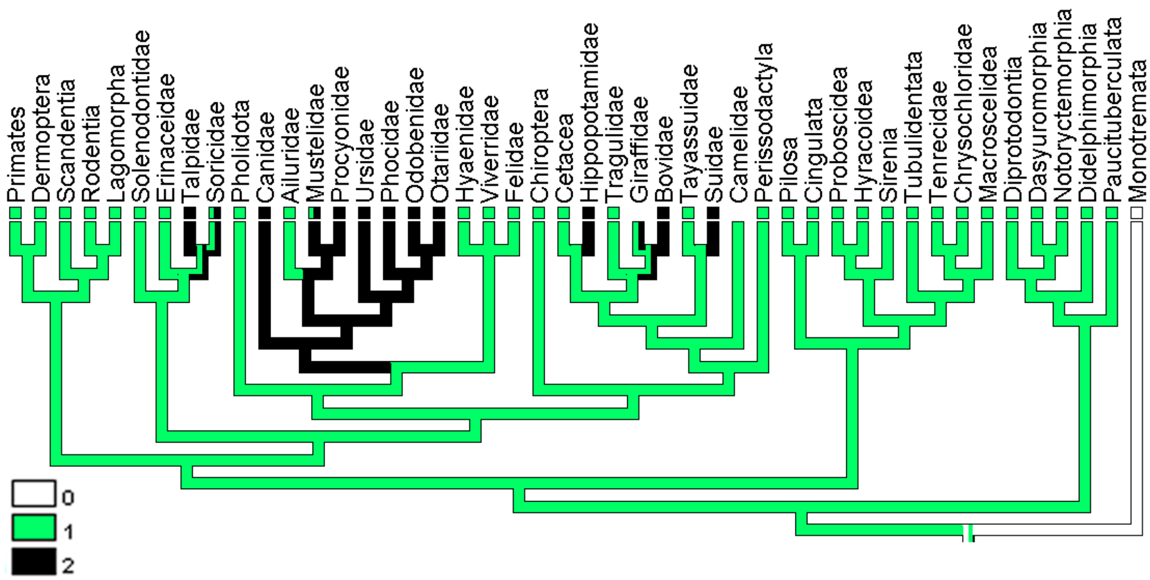


Figure 4.19. Phylogeny depicting character states of m. subscapularis.

Due to the different homologies of the bony structures of the shoulder girdle in Monotremata, m. subscapularis in *Tachyglossus* is found on the superficial surface of the scapula (Mivart, 1866; Walter, 1988). In eutherian mammals m. subscapularis is a very conservative muscle; generally it originates from the subscapular fossa and inserts on the lesser tuberosity (Jouffroy, 1971). This is the case in *Orcyteropus* and most other mammals. However, m. subscapularis is huge in bats (Vaughan, 1959), enlarged in Dermoptera (Jouffroy, 1971), and reduced in Hyracoidea (Jouffroy, 1971). In *Sorex* and many talpids the muscle has two heads of origin (Reed, 1951; Jullien, 1967; Whidden, 2000). The muscle is also often divided in the caniform carnivores (Murie, 1872d; Allen, 1882; Howell, 1929; Fisher, 1942; Davis, 1964; Feeney, 1999) and in artiodactyls (Beddard, 1909; Sisson, 1914; Jouffroy, 1971; Fisher et al., 2007).

Summary: *Orycteropus* and the afrotheres do not share the character of a doubled m. subscapularis seen in many Laurasiatheria.

Character 20. M. teres major
Inserts alone (0), inserts with latissimus dorsi (1)

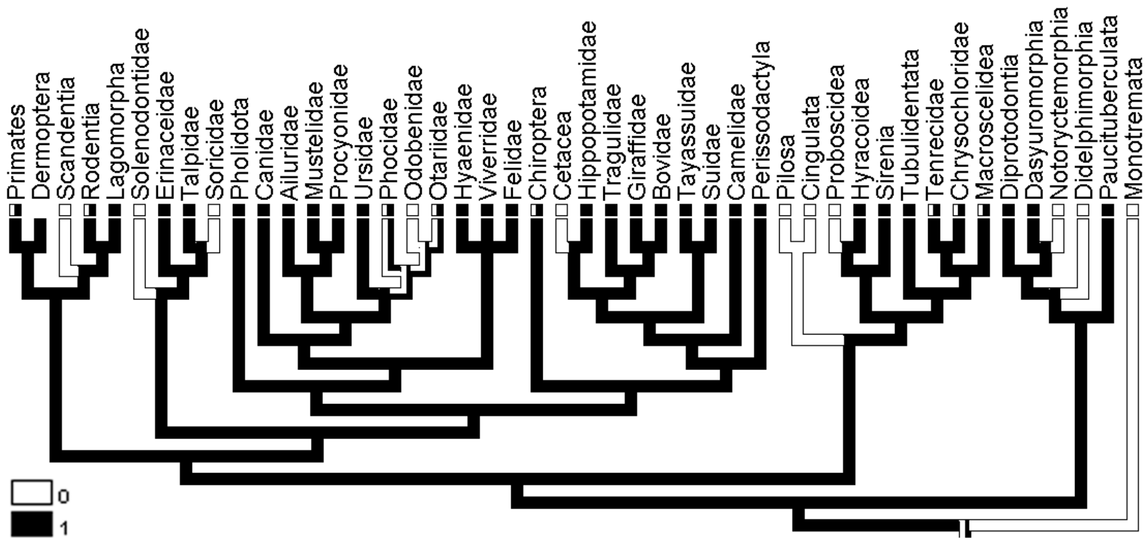


Figure 4.20. Phylogeny depicting character states of m. teres major.

M. teres major has probably evolved from m. subscapularis, given their shared innervation from the subscapular nerve[8] (Jouffroy, 1971; Diogo & Abdala, 2010). In marsupials and many afrotheres, particularly *Orycteropus*, and in *Cynocephalus* (Diogo & Abdala, 2010), m. teres major is connected at origin with m. subscapularis and has very little bony origin. In most mammals, however, it originates from the caudal border or caudal angle of the scapula. Despite its shared innervation with m. subscapularis, m.

[8] However, Galton (1869) describes the nerve supplying m. teres major in *Cyclopes* as splitting from the axillary nerve, and the axillary nerve innervates m. teres major in *Marmota* (Bezuidenhout & Evans, 2005) and in *Rattus* (Green, 1935).

teres major is often associated with m. latissimus dorsi because their tendons of insertion fuse and insert together in many mammals (Jouffroy, 1971).

The tendons of mm. latissimus dorsi and teres major are separate in Monotremata (Mivart, 1866; Coues, 1870; McKay, 1895; Allen, 1912; Walter, 1988), Didelphimorphia (Coues, 1872; Sidebotham, 1885; Jenkins & Weijs, 1972; Stein, 1981), and Notoryctemorphia (Wilson, 1894; Warburton, 2003). The tendons of insertion are fused in *Caenolestes* (Osgood, 1921), Dasyuromorphia (Cunningham, 1882; MacCormick, 1886; Jones, 1949), and Diprotodontia (Macalister, 1870; Cunningham, 1882; Parsons, 1896b; Sonntag, 1922b; Hopwood, 1974; Harvey & Warburton, 2010).

Within Afrotheria, the tendons of the two muscles are often fused, but this is not uniform within the different orders. In *Orycteropus*, the tendons are fused (Galton, 1870; Sonntag, 1925). There is only a tiny slip of fusion between the two tendons in *Calcochloris*, and this is absent or has been overlooked in other chrysochlorids (Parsons, 1901; Cambpell, 1938; Jullien, 1967; Puttick & Jarvis, 1977). The tendons are fused in *Potamogale* and *Micropotamogale* (Verheyen, 1961; Jullien, 1967), possibly fused in *Tenrec* (Dobson, 1883; Neveu & Gasc, 2002), but are not fused in *Microgale*. They are fused in Macroscelidea except *Rhynchocyon* (Jullien, 1967), in Hyracoidea (Murie & Mivart, 1865), in Sirenia (Murie, 1872a; Domning, 1978), but not in Proboscidea (Miall & Greenwood, 1878a; Windle & Parsons, 1901; Shino & Mori, 1956b).

The two tendons are not fused in Xenarthra (Galton, 1869a, 1869b; Humphry, 1869b; Murie, 1872b; Macalister, 1875a; Miles, 1941) or in Cetacea (Carte & Macalister, 1868; Murie, 1873b; Howell, 1930).

Within Eulipotyphla, the tendons are fused in Erinaceidae (Dobson, 1881a, 1882b; Jullien, 1967) and Talpidae (Dobson, 1883; Reed, 1951; Jullien, 1967; Widden, 2000), and separate in Solenodontidae (Allen, 1910) and Soricidae (Sharma, 1958; Gugler, 1959; Jullien, 1967; Neveu & Gasc, 2002).

In Chiroptera, the tendons are sometimes fused (Vaughan, 1959; Altenbach, 1979), and sometimes separate (Humphry, 1869a; Norberg, 1972; Hermanson & Altenbach, 1983). The same is true for Rodentia; sometimes the muscles are fused (Howell, 1932; Wood & White, 1950; Rinker, 1954; Woods, 1972; Stein, 1986; Ryan, 1989; Thorington et al., 1997), and sometimes separate (Parsons, 1898b; Greene, 1935; Young, 1937; Rinker, 1954; McEvoy, 1982; Bezuidenhout & Evans, 2005).

The two tendons are fused in Perissodactyla (Beddard & Treves, 1889; Sisson, 1914; Campbell, 1936; Budras & Sack, 2012), Artiodactyla (Murie, 1872c; Mivart, 1882; Reighard & Jennings, 1901; Beddard, 1909; Sisson, 1914; Campbell, 1936; Getty, 1975; Smuts & Bezuidenhout, 1987; Kneepkins et al., 1989; Fisher et al., 2007), Carnivora (Devis, 1868; Humphry, 1868; Watson & Young, 1879; Kelley, 1888; Young & Robinson, 1889; Beddard, 1900; Hall, 1926; Howell, 1929; Fisher, 1942; Davis, 1964; Getty, 1975; Leach, 1977; Spoor & Badoux, 1986a; Feeney, 1999; Fisher, 2009; Julik et al., 2012) except for some pinnipeds (Murie, 1872d; Howell, 1929), and *Manis* (Humphry, 1869b).

The muscle tendons are also separate in Scandentia (Le Gros Clark, 1924, 1926; Davis, 1938) and in most strepsirrhine Primates (Owen, 1866; Murie & Mivart, 1872; Woollard, 1925; Beattie, 1927; Hill, 1959; Schön, 1968; Soligo, 2005). In the Catarrhini, the tendons can be fused (Dobson, 1881b; Primrose, 1899; Sonntag, 1922a; Miller, 1952; Soligo, 2005) or separate (Patterson, 1942; Standring et al., 2005).

Summary: The tendons of mm. teres major and latissimus dorsi are fused in *Orycteropus* and in many, but not all, genera of afrotheres. Fusion of the two tendons is also noted for most Marsupialia and Laurasiatheria.

F. LATISSIMUS GROUP – THORACODORSAL NERVE

Character 21. M. latissimus dorsi

Full duplication of muscle (0), dual insertion of muscle, i.e., presence of Achselbogen muscle[9] (1), single insertion of muscle (2)

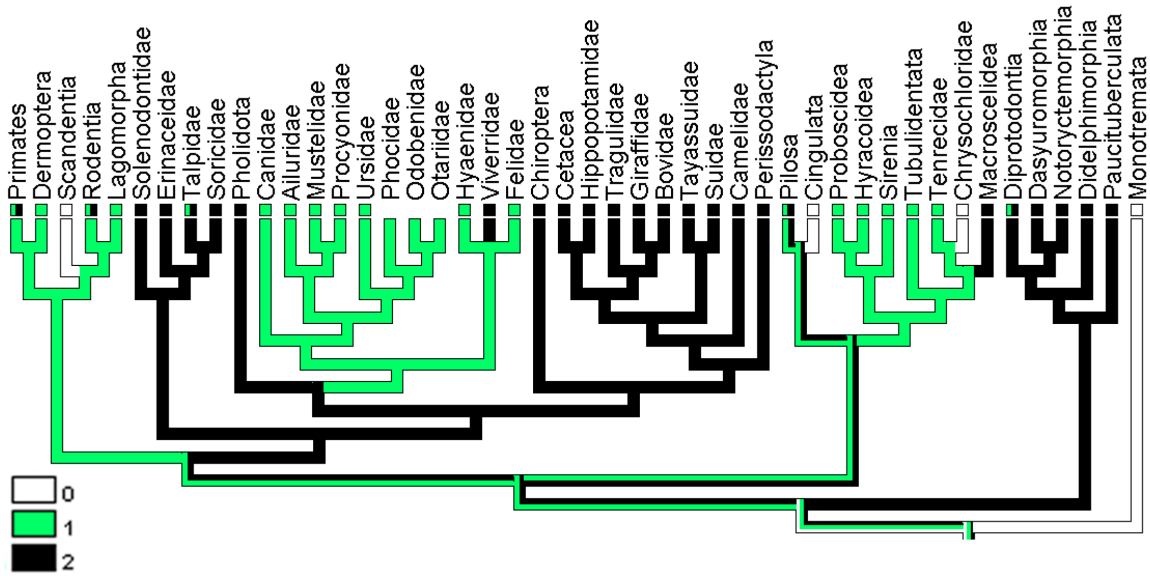


Figure 4.21. Phylogeny depicting character states of m. latissimus dorsi.

[9] axillopectoral muscle, Langer's axillary arch

M. latissimus dorsi is an expansive muscle originating along the trunk and thoracic and lumbar vertebrae via a broad aponeurosis (Jouffroy, 1971). M. dorso-epitrochlearis, often taking origin from m. latissimus dorsi, is discussed below with mm. triceps brachii. As already discussed, the tendon of m. latissimus dorsi may be connected with the tendon of m. teres major at insertion, or the muscle may insert alone on the medial humerus. There may also be what appears to be an additional insertion of m. latissimus dorsi, where a small portion of m. latissimus dorsi bridges the axillary vessels and brachial plexus to join with mm. pectoralis (Patterson, 1942; Jouffroy, 1971). This additional insertion has been called an Achselbogen muscle, which "seems to spring from the axillary edge of the latissimus... as if a band of the substance of the latissimus had been bent across the axilla to the opposite border, where it blends with the pectoralis major" (Birmingham, 1889: 211). Rarely, there may also be complete duplication of m. latissimus dorsi (Jouffroy, 1971).

There is obvious confusion in the literature regarding the provenance of the Achselbogen muscle and the second head of m. latissimus dorsi. These muscles may be related to m. panniculus carnosus, which "at the humerus is closely associated with the posterolateral pectoral musculature and with the M. latissimus dorsi" (Reed, 1951: 636). A branch of the anterior thoracic nerve may innervate the Achselbogen muscle, thus supporting this association with m. panniculus carnosus (Birmingham, 1889; Wilson, 1912). However, in Carnivora, the Achselbogen muscle is innervated by the thoracodorsal nerve (Jouffroy & Saban, 1971). The Achselbogen muscle of *Proechimys* is innervated by both thoracodorsal and anterior thoracic nerves, indicating the muscle is probably formed by fibers from both m. latissimus dorsi and m. panniculus carnosus

(Woods, 1972). As a large m. panniculus carnosus coexists with several Achselbogen in, for example, the Hyracoidea, the Achselbogen muscle is considered here with m. latissimus dorsi, and m. panniculus carnosus is considered below with the mm. pectoralis.

In *Tachyglossus*, m. latissimus dorsi inserts on the medial epicondyle (Mivart, 1866). Another muscle called the "dermo flexor antebrachii" portion of m. panniculus carnosus or the "dorsoantebrachialis" has been considered a second sheet of m. latissimus dorsi in some descriptions; it arises from the ribs and inserts on the pisiform with m. flexor carpi ulnaris (Mivart, 1866; Fewkes, 1878; Walter, 1988). Indeed, in both *Zaglossus* and *Tachyglossus*, m. latissimus dorsi is positionally related to another cutaneous muscle that retracts the spines of the animal. The three muscles may once have been part of a single sheet (Allen, 1912). In *Ornithorhynchus*, the "brachio-dermal" portion of m. panniculus carnosus overlies m. latissimus dorsi and inserts on the humerus with m. pectoralis superficialis (Coues, 1870).

In the wombat, a slip suspected of belonging to m. panniculus carnosus departs from m. latissimus dorsi and passes over the axillary vessels and nerves to fuse with the tendon of m. pectoralis superficialis (Galton, 1869a). This is probably an Achselbogen muscle. Such a muscle is not mentioned in other marsupials.

Based on innervation, m. latissimus dorsi is doubled in *Calcochloris*, consisting of the superficial and medial portion, which is the typical m. latissimus dorsi with a bony insertion on the medial epicondyle, and a deeper and more lateral portion from the ribs, which inserts into mm. pectoralis (Dobson, 1883; Campbell, 1938; Jullien, 1967; Puttick & Jarvis, 1977).

In other afrotheres, there are additional Achselbogen insertions of m. latissimus dorsi, into mm. pectoralis, panniculus carnosus, or even onto the humerus itself, which may represent the remnant of this second muscle. There is an Achselbogen crossing over the brachial vessels and nerves and inserting into the pectorals in the Tenrecidae (Dobson, 1883; Verheyen, 1961; Jullien, 1967; Neveu & Gasc, 2002). There are several varied Achselbogen slips of m. latissimus dorsi crossing over the brachial vessels and nerves and inserting with mm. panniculus carnosus and pectoralis in the Hyracoidea (Murie & Mivart, 1865; Windle & Parsons, 1901). These slips were not observed in the Macroscelididae (Jullien, 1967). In Proboscidea, there are two insertions of m. latissimus dorsi, splitting around the insertion of m. teres major (Miall & Greenwood, 1878a; Windle & Parsons, 1901; Shindo & Mori, 1956a). Two portions of m. latissimus dorsi are noted for *Trichechus* (Domning, 1978). In *Orycteropus*, the muscle fibers of mm. latissimus dorsi, panniculus carnosus, and pectoralis abdominalis have become so connected at the axilla that they cannot be separated without arbitrary use of a scalpel.

The only mention of two insertions of m. latissimus dorsi in Eulipotyphla is for *Talpa*, and both portions insert on the tendon of m. teres major (Jullien, 1967), so it is not certain if this represents an Achselbogen muscle or if it is simply individual variation.

Among Xenarthra, there are dual insertions of m. latissimus dorsi in *Cyclopes*. In Cingulata, there is a typical m. latissimus dorsi that originates from the vertebrae and passes deep to the neurovascular bundle to insert as usual on the medial humerus (Galton, 1869b). There is also another muscle that has been considered a second part of m. latissimus dorsi. It takes origin from the ribs immediately deep to m. latissimus dorsi and generally inserts with m. pectoralis superficialis. In *Euphractus*, the costal origin of m.

latissimus dorsi crosses superficial to the axillary vessels and brachial plexus to join with the tendon of m. pectoralis superficialis, which "bears very great resemblance to... the "Achselbogen" of German anatomists" (Galton, 1869a: 532).

Similarly, in *Mandrillus*, a "long, narrow muscle… takes origin from the free edge of the latissimus dorsi, crosses the axillary vessels and brachial nerves, and spreads out into a thin fan-shaped aponeurosis. The latter covers the coraco-brachialis and biceps, and is inserted into the deep surface of the pectoralis major" (Sonntag, 1922a: 432). Achselbogen muscles, or the axillary arch of Langer "are by no means uncommon in the human subject as slips which pass from this muscle [latissimus dorsi] over the axillary vessels and nerves to join the tendon of the pectoralis major at its insertion" (Galton, 1869a: 532; Macalister, 1869a; Birmingham, 1889; Wilson, 1912; Kalaycioglu et al., 1998; Standring et al., 2005; Bakirci et al., 2010).

In Scandentia, there is a muscle called "spino-humeralis," which extends from the thoracic vertebrae to the humerus in conjunction with m. teres major (Le Gros Clark, 1924; Davis, 1938; George, 1977). This seems to be a fully separate second portion of m. latissimus dorsi. In Dermoptera, a slip of m. latissimus dorsi joins the patagium (Jouffroy, 1971), or an Achselbogen inserts into m. panniculus carnosus (Champneys, 1871). There is an Achselbogen muscle in some rodents (Woods, 1972; McEvoy, 1982), innervated by the thoracodorsal nerve (Langworthy, 1925). An Achselbogen muscle leaves the ventral edge of m. latissimus dorsi to insert with m. pectoralis profundus on the greater tuberosity of the humerus in the rabbit (Langworthy, 1925).

M. latissimus dorsi has a single insertion in the Chiroptera (Humphry, 1869a; Vaughan, 1959; Norberg, 1972; Altenbach, 1979; Hermanson & Altenbach, 1983), Perissodactyla (Beddard & Treves, 1889; Sisson, 1914; Campbell, 1936), and Artiodactyla (Murie, 1872c; Beddard, 1909; Sisson, 1914; Campbell, 1936; Getty, 1975; Smuts & Bezuidenhout, 1987; Kneepkins et al., 1989; Fisher et al., 2007). There is a two-part m. latissimus dorsi in *Monodon* (Howell, 1930) but not in other Cetacea.

In Carnivora there is an Achselbogen muscle joining mm. pectoralis or panniculus carnosus in *Leopardus*, *Felis*, *Crocuta, Ailuropoda, Ailurus*, *Procyon*, and several mustelids (Watson & Young, 1879; Allen, 1882; Hall, 1926; Fisher, 1942; Davis, 1964; Getty, 1975; Leach, 1977; Fisher, 2009; Julik et al., 2012). Achselbogen muscles also occur in domesticated dogs and cats (Langworthy, 1925; Jouffroy & Saban, 1971). In *Manis*, however, there is only a single insertion of m. latissimus dorsi (Humphry, 1869b),

Summary: The appearance of a doubled m. latissimus dorsi in *Tachyglossus*, *Calcochloris,* Scandentia, and xenarthrans such as *Euphractus* suggests that this feature is primitive within mammals. M. latissimus dorsi completely co-mingled with m. panniculus carnosus as in *Orycteropus*, or an Achselbogen muscle connecting m. latissimus dorsi with mm. pectoralis and panniculus carnosus as found in most afrotheres, some Euarchontoglires, and Carnivora, would therefore be more derived. Mammals in which there is a single insertion of m. latissimus dorsi and no Achselbogen slips of connection with mm. pectoralis or panniculus carnosus are probably the most derived.

G. PECTORALS GROUP – PECTORAL NERVES

The lack of consistent terminology in the literature and the generally insufficient descriptions of the different portions of mm. pectoralis make a discussion of the comparative anatomy of this muscle sheet difficult (Jouffroy, 1971). Windle & Parsons (1901) stated, "the subdivisions of these vary immensely, and it would be impossible to quote all the combinations which are described, nor do we think it desirable to do so as the arrangements are not even constant for the same animal." I think much additional information could be revealed by new careful dissections of mm. pectoralis in all mammalian groups; the literature is too confused. Ignoring the vagaries of attachment (or description), general patterns of presence and absence of particular portions are identifiable.

There are four main portions of mm. pectoralis: m. pectoralis superficialis[10], which is frequently subdivided, m. pectoralis profundus[11], m. pectoralis abdominalis[12], and m. panniculus carnosus[13]. While I have grouped mm. subclavius[14] and sternoscapularis[15] here with these muscles for convenience as they are often described together, they are not thought to be derived from the same pectoral mass (Jouffroy, 1971).

[10] ectopectoralis, grand pectoral, pectoralis anterior division / major / pars anticus / pars posticus

[11] entopectoralis, pectoralis major deep head / minor / pars profundus / posterior division, petit pectoral

[12] abdomino-humeralis, brachio-abdominalis, pectoralis quartus, pannicular division pectoralis, xiphihumeralis

[13] cutaneous maximus, cutaneus trunci, dermo-humeralis, humero-dorsalis, subcutaneus trunci

[14] sous-clavier, sterno-clavicularis

[15] cleidoscapularis, costo-scapularis, costo-scapulaire, retro-clavicularis, scapulo-clavicularis, sterno-clavicularis, sterno-costalis, sterno-scapulatus, sterno-scapular, sterno-scapularis, subclavius

Character 22. M. panniculus carnosus

Large muscle with bony insertion (0), medium muscle with no bony insertion (1), muscle is small or absent (2)

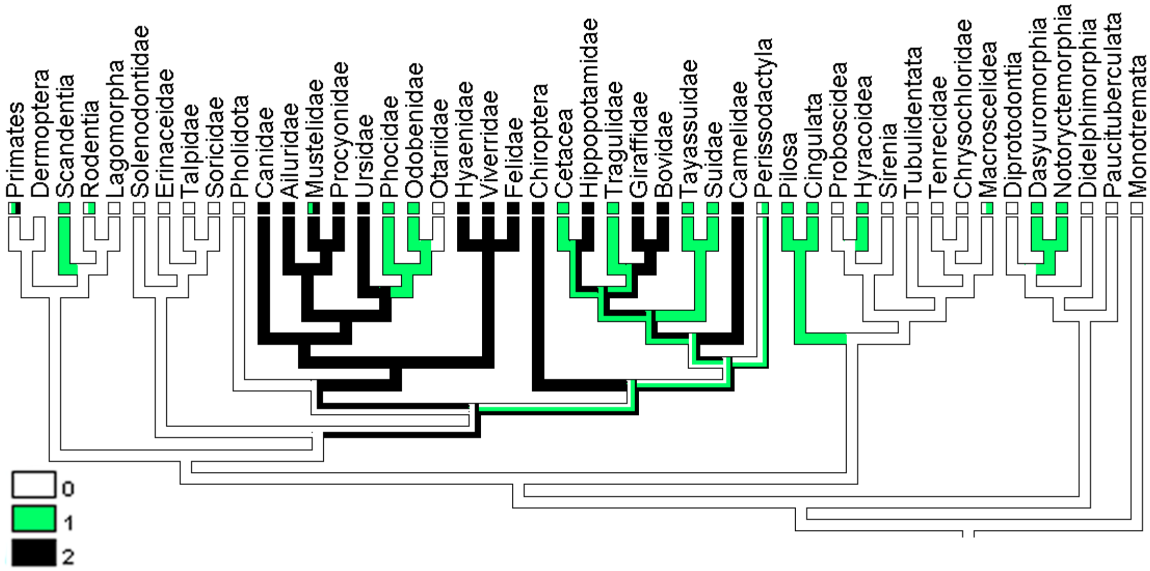


Figure 4.22. Phylogeny depicting character states of m. panniculus carnosus.

Within the literature, m. panniculus carnosus is a term often applied to the entire collection of cutaneous musculature of the trunk, with its special subdivisions given a myriad of names based on their various attachments, or sometimes described with mm. pectoralis (Dobson, 1881a, 1882b, 1883; Osgood, 1921; Jouffroy & Saban, 1971). The main division of m. panniculus carnosus, often called "humero-dorsalis" (Jouffroy & Saban, 1971), extends from the lateral edge of the thigh to the humerus in many mammals. I opted to retain the general term m. panniculus carnosus in my descriptions, though the term "cutaneus trunci" is employed by the Nomina Anatomica Veterinaria (2005) for the reduced cutaneous musculature seen in domesticated mammals. Reed (1951) states that m. panniculus carnosus "at the humerus is closely associated with the posterolateral pectoral musculature and with the latissimus dorsi." Both m. pectoralis abdominalis (described below) and an Achselbogen muscle (described with m. latissimus dorsi) can coexist with m. panniculus carnosus, but they are clearly closely related. Further study of the development of all the cutaneous musculature is needed.

M. panniculus carnosus is thought to be derived from the primitive pectoralis (Howell, 1937). "There is no justification for considering this sheet as anything but a derivative of the primitive pectoral complex… for the innervation of the entire sheet is invariably by the anterior thoracic nerve, the same as for the pectorals" (Howell, 1932: 439). McKay's (1894) description of the divisions of mm. pectoralis sandwiched between layers of m. panniculus carnosus in monotremes may lend support to this idea. He also states that the innervation of m. panniculus carnosus in *Ornithorhynchus* is partly by the "lateral cutaneous nerve of the thorax" (from the seventh cervical through second thoracic nerves), which has a connection to the nerve fibers which supply mm. pectoralis. In *Dasypus*, anterior thoracic nerve innervation of m. panniculus carnosus has been verified by both dissection and electrode stimulation of the nerve (Miles, 1940, 1941), and innervation by anterior/lateral thoracic nerves (= medial/lateral pectoral nerves of humans) is recorded for other mammals (Parsons, 1896b, for *Petrogale*; Michelsson, 1921, for *Erinaceus*; Le Gros Clark, 1924, for *Tupaia*; Howell, 1932, for *Dipodomys*; Green, 1935, for *Rattus*; Campbell, 1936, for artiodactyls; Reed, 1951, for *Scapanus*; Jouffroy & Saban, 1971, for Cetacea; Budras, 2007, for *Canis*).

Coues (1870: 128) notes that m. panniculus carnosus in *Ornithorhynchus* "is remarkable not only for its great extent, but for its thickness in most parts, the various directions of its fibres, and the number and diversity of its accessory slips and their attachments." In monotremes, the slips insert on the humerus, ulna, and hyoid (McKay, 1894), and have several seemingly important connections with mm. pectoralis (Coues, 1870; McKay, 1895; Fewkes, 1898; Allen, 1912).

In *Didelphis*, m. panniculus carnosus has various connections with the tendons of insertion of mm. pectoralis and has a bony insertion on the lateral bicipital groove of the humerus (Coues, 1872). The situation in *Caenolestes* is similar (Osgood, 1921). There is little published on this muscle in dasyuromorphs and diprotodonts, except that the muscle is "weak and undefined" in *Sarcophilus* (Macalister, 1870), and inserts on the humerus in *Phascolarctos* (Young, 1882). M. panniculus carnosus forms an axillary arch crossing the vessels in *Notoryctes* (Wilson, 1894).

Similarly, there are slips of the enormous m. panniculus carnosus inserting with mm. pectoralis and on the pectoral crest of the humerus in *Orycteropus* (Humphry, 1868; Sonntag, 1925). The Tenrecidae also have m. panniculus carnosus inserting on the humerus (Dobson, 1882a, 1883; Verheyen, 1961). There is a bony insertion on the metacromion in chrysochlorids and *Rhynchocyon* (Dobson, 1883; Parsons, 1901; Campbell, 1938). In other macroscelidids and in hyracoids, the muscle ends in fascia at the axilla and sends slips to mm. pectoralis (Murie & Mivart, 1865). M. panniculus carnosus of *Elephas* inserts on the scapula (Miall & Greenwood, 1878a; Shindo & Mori, 1956b), while there are a variety of insertions including the humerus in sirenians (Murie, 1872a, 1885; Domning, 1977, 1978). Thus, the extensive m. panniculus carnosus with bony insertions and accessory slips observed in *Orycteropus* and other afrotheres seems to be primitive.

M. panniculus carnosus is fairly well developed in the Pilosa (Jouffroy & Saban, 1971), although the Folivora have a "weak" panniculus carnosus when compared with the more extensive muscle sheet attached to the carapace in *Dasypus* (Macalister, 1869a). No xenarthrans have a bony attachment of m. panniculus carnosus; the muscle ends in fascia over the deltoideus or on the carapace (Miles, 1941).

Eulipotyphlans have a large m. panniculus carnosus with a bony insertion on the humerus (Dobson, 1881a, 1882b; Reed, 1951; Sharma, 1958; Whidden, 2000). In *Erinaceus*, it inserts on both the humerus and the metacromion (Dobson, 1882b). Allen (1910) called the muscle "extraordinarily developed" in *Solenodon*, and it inserts broadly along the vertebral border of the scapula, the spine of the scapula, and the humerus.

In Chiroptera, there are several unusual cutaneous muscles associated with the wing membrane, and though I am not certain of their homology in this order, there does not seem to be a bony insertion (Vaughan, 1959; Norberg, 1972).

In *Tapirus*, m. panniculus carnosus ends in fascia over mm. triceps brachii or deltoideus (Murie, 1871; Campbell, 1936). The muscle is fairly extensive in *Equus*, with an insertion on the lesser tuberosity and slips joining the pectorals (Sisson, 1914). This is unusual, as ungulates typically have a reduced m. panniculus carnosus (Jouffroy & Saban, 1971).

In *Camelus*, there are "rudimentary fascicles" of m. panniculus carnosus over m. triceps brachii (Smuts & Bezuidenhout, 1987). The muscle sheet is broad and thin in the Suina and smaller in Ruminantia and Hippopotamidae, ending in fascia over the shoulder with a slip to m. latissimus dorsi (Beddard, 1909; Campbell, 1936). M. panniculus carnosus covers the whole body in Cetacea, and ends near the axilla with slips joining mm. latissimus dorsi and pectoralis (Murie, 1873b; Howell, 1927, 1930).

M. panniculus carnosus is less developed in feliforms, often joining m. latissimus dorsi (Devis, 1868; Watson & Young, 1879; Young & Robinson, 1889; Reighard & Jennings, 1901). It is also "feebly developed" in *Ailuropoda*, and joins m. pectoralis profundus (Davis, 1964). However, the muscle is "all-enveloping" in *Lutra* (Fisher, 1942) and "extensively developed" with an insertion on the humerus or the scapula in otariids (Murie, 1872d). Likewise, in *Manis*, m. panniculus carnosus is robust and has an insertion on the greater tuberosity of the humerus with m. pectoralis profundus (Jouffroy & Saban, 1971).

As frequently seems to be the case with rodents, there is a wide array of variation in the attachments of m. panniculus carnosus within the order. Sometimes it has a scapular attachment. For example, in both *Castor* and *Proechimys*, it attaches on the spine of the scapula, the humerus, and sends slips to mm. pectoralis (Young, 1937; Woods, 1972). In most rodents it is inserted into the humerus with mm. pectoralis (Hollinger, 1916; Langworthy, 1925; Howell, 1932; Greene, 1935; Wood & White, 1950; Rinker, 1954; Ryan, 1989; Thorington et al., 1997). In *Marmota*, it merely joins m. latissimus dorsi (Bezuidenhout & Evans, 2005). In the rabbit, m. panniculus carnosus inserts on the greater tuberosity of the humerus deep to m. pectoralis profundus (Langworthy, 1925).

In tree shrews, the "dorso-humeralis" muscle is a remnant of a more extensive m. panniculus carnosus; it inserts either on the shaft of the humerus or with m. pectoralis profundus on the gleno-humeral joint capsule (Le Gros Clark, 1924, 1926; George, 1977). M. panniculus carnosus is not often described in Primates, but it can have similar attachments to the humerus and mm. pectoralis (Beattie, 1927; Patterson, 1942).

Summary: An extensive m. panniculus carnosus with bony insertions seems to be the primitive state, and is shared by Monotremata, most Marsupialia, most Afrotheria, many Euarchontoglires, Eulipotyphla, Perissodactyla, and Pholidota. Xenarthrans and most Artiodactyla and Carnivora have a reduced m. panniculus carnosus. Thus, *Orycteropus* has the primitive state of an extensive m. panniculus carnosus, while Artiodactyla has a more derived, reduced m. panniculus carnosus. Hyracoidea and Macroscelidea have a medium-sized m. panniculus carnosus.

Character 23. M. pectoralis abdominalis
Absent or vestigial (0), present (1)

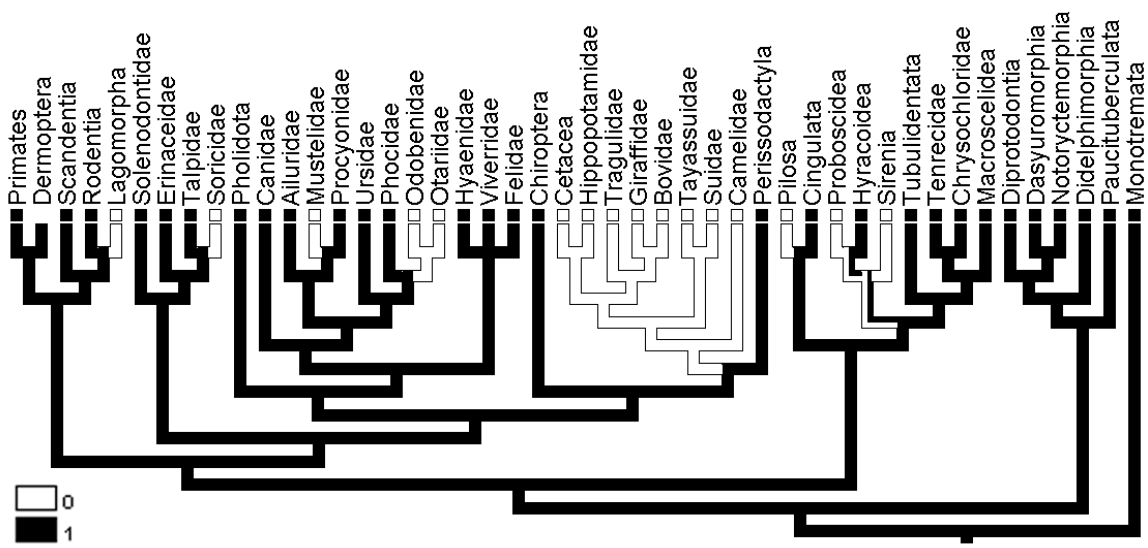


Figure 4.23. Phylogeny depicting presence of m. pectoralis abdominalis.

M. pectoralis abdominalis seems to be an "intermediate piece of the great superficial external muscular sheet" situated between mm. pectoralis superficialis and latissimus dorsi (Macalister, 1870:159). This muscle is often called the "pectoralis quartus" in marsupials (Young, 1882), but it is not listed in the Nomina Anatomica Veterinaria (2005) or the Terminologica Anatomica (1998). Thus I selected a commonly applied name from the literature, m. pectoralis abominalis. Commonly, the muscle originates from the xiphisternum, or the rectus sheath or m. external oblique, and inserts on the humerus with mm. pectoralis or latissimus dorsi or onto a common fascia between those muscles. It is found throughout mammals, though is often neglected or given an unusual name in descriptions of mm. pectoralis and thus is a difficult muscle to consider fully. This feature was scored as simple presence or absence of a named portion of mm. pectoralis originating from the abdomen; however, if other mm. pectoralis are lacking it is possible that the abdominal portion is homologous with one of those and has merely shifted origin.

The muscle is found in Monotremata (McKay, 1895; Allen, 1912). It is also present in all Marsupialia (Macalister, 1870; Coues, 1872; Cunningham, 1882; Young, 1882; Sidebotham, 1885; MacCormick, 1886; Wilson, 1894; Parsons, 1896b; Osgood, 1921; Jones, 1949; Jenkins & Weijs, 1979; Warburton, 2003, 2011; Harvey & Warburton, 2010).

This muscle is present as an individual muscle in most afrotheres except Proboscidea and Sirenia (Humphry, 1868; Galton, 1870; Dobson, 1882a, 1883; Windle & Parsons, 1901; Sonntag, 1925; Verheyen, 1961; Jullien, 1967; Thewissen & Badoux, 1986; Neveu & Gasc, 2002). In many afrotheres, particularly *Orycteropus*, mm. pectoralis abdominalis, panniculus carnosus, and latissimus dorsi are very similar to the configuration described for *Trichosurus* (MacCormick, 1886) and *Procyon* (Allen, 1882). These muscles and the other mm. pectoralis converge upon a central fascia, forming a bursa-like structure that glides superficial to m. biceps brachii, the “bicipital arch” (Wilder & Gage, 1882; Reighard & Jennings, 1901). This structure is described in *Procyon* as a “tensor of the sheath of the biceps and of the capsule of the shoulder-joint” (Allen, 1882:119).

M. pectoralis abdominalis is not mentioned for the sloths and anteaters, but is present in Cingulata (Macalister, 1875a; Miles, 1941).

M. pectoralis abdominalis is found in eulipotyphlans except Soricidae, but is not always recognized as such (Dobson, 1881a, 1882b, 1883; Parsons, 1898a; Reed, 1951; Jullien, 1967; Whidden, 2000; Neveu & Gasc, 2002). It also seems to be present in Chiroptera (Humphry, 1869a; Vaughan, 1959; Norberg, 1972; Altenbach, 1979; Hermanson & Altenbach, 1983).

M. pectoralis abdominalis is present in *Manis* (Humphry, 1869b). It is also seen in Perissodactyla, but may tend to fuse with m. pectoralis profundus (Windle & Parsons, 1901; Sisson, 1914). This is also the case in the Carnivora, in which m. pectoralis abdominalis is not always described and frequently is absent or fused with mm. panniculus carnosus or pectoralis (Devis, 1868; Humphry, 1868; Allen, 1882; Kelley, 1888; Reighard & Jennings, 1901; Fisher, 1942; Davis, 1964; Spoor & Badoux, 1986a; Fisher et al., 2009; Julik et al., 2012).

Within Artiodactyla, m. pectoralis abdominalis is described by Windle & Parsons (1901) but not by other authors. I observed a vestigial sheet of muscle on the lateral thorax in *Pecari*, and the origin of m. pectoralis profundus can extend to the abdomen in artiodactyls (Campbell, 1936; Getty, 1975; Fisher et al., 2007), possibly indicating that

m. pectoralis abdominalis has been incorporated into the muscle. M. pectoralis abdominalis is absent in Cetacea.

M. pectoralis abdominalis is found throughout Rodentia (Parsons, 1898b; Langworthy, 1925; Howell, 1932; Greene, 1935; Young, 1937; Wood & White, 1950; Rinker, 1954; Woods, 1972; McEvoy, 1982; Ryan, 1989; Thorington et al., 1997; Bezuidenhout & Evans, 2005). The muscle is absent in Lagomorpha, however (Langworthy, 1925).

It is also seen in Scandentia and in many Primates (Murie & Mivart, 1872; Dobson, 1881b; Primrose, 1899; Sonntag, 1922a; Le Gros Clark, 1924, 1926; Beattie, 1927; Davis, 1938; Parsons, 1942; Miller, 1952; Hill, 1959; Schön, 1968; George, 1977).

Summary: Most mammals, including *Orycteropus* and the majority of afrotheres, possess m. pectoralis abdominalis. This muscle is absent or vestigial in Artiodactyla, Proboscidea, and Sirenia, however.

Character 24. M. subclavius

(0) absent, (1) inserts on clavicle, (2) inserts on scapula, (3) inserts on coracoid

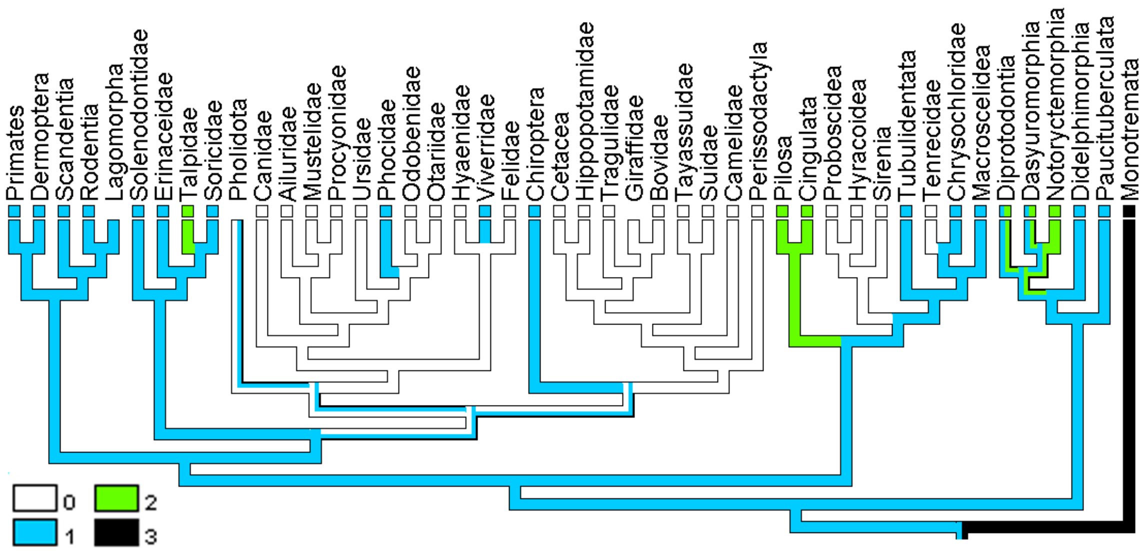


Figure 4.24. Phylogeny depicting character states of m. subclavius.

Character 25. M. sternoscapularis

Absent (0), originates on sternum or ribs (1), originates on clavicle (2)

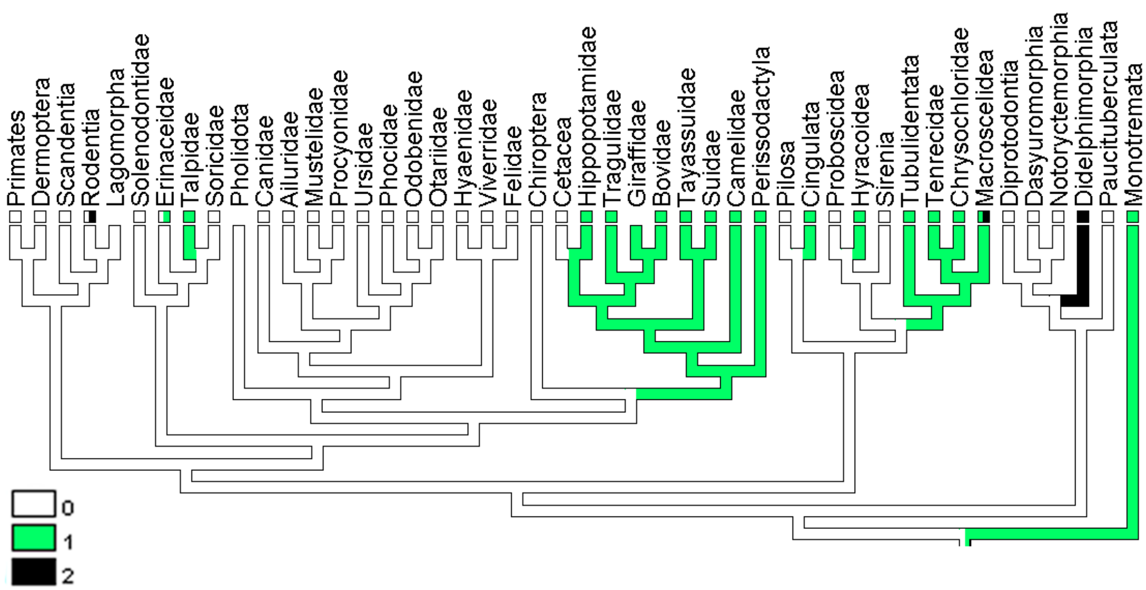


Figure 4.25. Phylogeny depicting character states of m. sternoscapularis.

M. sternoscapularis typically originates from the first rib or sternum and inserts on the acromion or fascia over m. supraspinatus. If the muscle has lost its sternal attachment, it is known as "costoscapularis" or "cleidoacromialis" or "cleidoscapularis." M. subclavius originates on the first rib or manubrium and inserts on the clavicle (Jouffroy, 1971). Occasionally some fibers terminate on the clavicle while other fibers continue on to the scapula. This might indicate that m. sternoscapularis has become incorporated into m. subclavius, but it is not clear. According to Jouffroy (1971:54, my translation), the two muscles are "often not separable" and "they give rise to frequent misunderstandings and confusions of terminology." They also share innervation from the nerve to the subclavius. In eutherian mammals, if there is only a single muscle connecting the sternum with the scapula and no fibers attach to the clavicle or clavicular intersection, I consider m. subclavius to be absent.

In Monotremata, a muscle potentially homologous with m. subclavius originates from the first rib and inserts on the coracoid. There is a second muscle, potentially homologous with m. sternoscapularis, which originates from the manubrium and first rib and inserts on the epicoracoid (Coues, 1870; McKay, 1895; Mivart, 1866; Walter, 1988).

Didelphimorphia have a typical m. subclavius inserting on the clavicle, and a "cleidoacromialis" continuing from the clavicle to the acromion or spine of the scapula (Coues, 1872; Sidebotham, 1885; Jenkins & Weijs, 1979; Stein, 1981). No other marsupials have m. sternoscapularis; "cleidoacromialis" is perhaps not homologous. M. subclavius reaches the acromion in the marsupial mole *Notoryctes*, the diprotodont *Vombatus*, and the dasyurids *Dasycercus* and *Thylacinus*, and it is possible that some fibers of m. sternoscapularis are confluent (Macalister, 1870; Cunningham, 1882; Wilson, 1894; Sonntag, 1922b; Jones, 1949; Warburton, 2003). In other members of Diprotodontia and Dasyuromorphia and in Paucituberculata m. subclavius is typical (Macalister, 1870; Cunningham, 1882; MacCormick, 1886; Parsons, 1896b; Osgood, 1921; Sonntag, 1922b; Warburton, 2011).

The condition of the two muscles in *Orycteropus* is quite typical, though they have been described together (Humphry, 1868; Galton, 1870; Sonntag, 1925). The muscles are definitely separate in the Chrysochloridae (Dobson, 1883; Campbell, 1938; Jullien, 1967; Gasc et al., 1986). The Macroscelididae all have a typical m. subclavius. In *Rhynchocyon*, there is a typical m. sternoscapularis, but in other elephant shrews there is instead a "cleidoscapularis" (Jullien, 1967).

In the Tenrecidae, mm. subclavius and sternoscapularis have been described as absent (Dobson, 1882a, 1883; Verheyen, 1961; Jullien, 1967; Jouffroy, 1971; Neveu & Gasc, 2002). However, Dobson (1882) observed m. subclavius in one specimen of *Microgale* (possibly this was m. sternoscapularis), and I observed what seems to be m. sternoscapularis in both *Potamogale* and *Microgale*. Based on my own observations rather than the literature, I scored m. subclavius as absent and m. sternoscapularis as present in Tenrecidae.

M. subclavius is described as absent in the Hyracoidea (Murie & Mivart, 1865; Windle & Parsons, 1901; Jouffroy, 1971), but I observed some fibers from the manubrium to the clavicular intersection in *Heterohyrax*. M. sternoscapularis is typical. Both mm. subclavius and sternoscapularis are absent in Proboscidea and Sirenia (Murie, 1872a, 1885; Miall & Greenwood, 1878a; Anderson, 1883; Windle & Parsons, 1901; Shindo & Mori, 1956a; Domning, 1977, 1978).

In Xenarthra, m. subclavius extends to the scapula, but it is absent in *Cyclopes* (Galton, 1869b; Humphry, 1869b; Macalister, 1869a; Murie, 1872b; Miles, 1941). In Pilosa, m. sternoscapularis is absent (Galton, 1869b; Humphry, 1869b; Macalister, 1869a), but in a few Cingulata the "retro-clavicularis," which extends between the first rib and the acromion, may be homologous with m. sternoscapularis (Macalister, 1875a).

In Eulipotyphla, m. subclavius is typical (Dobson, 1881a, 1882b; Parsons, 1898a; Allen, 1910; Reed, 1951; Sharma, 1958; Gugler, 1959; Jullien, 1967; Neveu & Gasc, 2002). M. sternoscapularis is absent except in the talpids and the erinaceomorphs *Erinaceus* and *Echinosorex*, where it inserts on the clavicle (Dobson, 1881a; Reed, 1951; Jullien, 1967). Whidden (2000) describes m. subclavius with three heads in talpids, presumably including both mm. subclavius and sternoscapularis in a single description.

In Chiroptera, there is a typical m. subclavius, and m. sternoscapularis is absent (Humphry, 1869a; Vaughan, 1959; Norberg, 1972; Altenbach, 1979; Hermanson & Altenbach, 1983). The opposite is true in Perissodactyla; m. subclavius is absent, but there is a typical m. sternoscapularis (Murie, 1871; Windle & Parsons, 1901; Sisson, 1914; Campbell, 1936). The situation is the same in Artiodactyla. While the muscle extending from the manubrium and first rib to the fascia over m. supraspinatus is generally regarded as m. subclavius or mm. subclavius and sternoscapularis, no fibers attach to the clavicular intersection in most artiodactyls (Windle & Parsons, 1901; Campbell, 1936; Smuts & Bezuidenhout, 1987). However, the muscle inserts on the clavicular intersection in the Bovidae and in one specimen of *Choeropsis* (Sisson, 1914; Jouffroy, 1971; Getty, 1975; Fisher at al, 2007). Thus, I consider this muscle to be m. sternoscapularis in all artiodactyls, with a truncated insertion in the Bovidae and possibly

Hippopotamidae. No mention is made of either muscle in Cetacea; presumably both are absent (Carte & Macalister, 1868; Murie, 1873b; Howell, 1930; Jouffroy, 1971).

Both mm. subclavius and sternoscapularis are typically absent in Carnivora (Davis, 1964; Getty, 1975). However, there is m. subclavius in *Genetta* (Mivart, 1882) and *Phoca* (Humphry, 1868). M. subclavius is absent in Pholidota (Jouffroy, 1971).

In Rodentia m. subclavius is typical (Parsons, 1898b; Howell, 1932; Greene, 1935; Young, 1937; Woods & White, 1950; Rinker, 1954; Woods, 1972; McEvoy, 1982; Ryan, 1989; Thorington et al., 1997; Bezuidenhout & Evans, 2005). M. sternoscapularis is absent in Anomaluromorpha, Castorimorpha except *Heteromys* (Ryan, 1989), Dipodidae (Howell, 1932), and Sciuridae (Thorington et al., 1997; Bezuidenhout & Evans, 2005).

In Dermoptera, Scandentia, and Primates, m. subclavius is typical and m. sternoscapularis is absent (Murie & Mivart, 1872; Beddard, 1891; Primrose, 1899; Sonntag, 1922a; Le Gros Clark, 1924, 1926; Woollard, 1925; Beattie, 1927; Davis, 1938; Patterson, 1942; Miller, 1952; Hill, 1959; Schön, 1968; George, 1977; Standring et al., 2005; Diogo & Abdala, 2010).

Summary: M. subclavius is absent in cursorially adapted mammals, which are often aclaviculate. Paenungulates and Tenrecidae also lack m. subclavius, whereas *Orycteropus*, Chrysochloridae, and Macroscelididae possess m. subclavius.

M. sternoscapularis is absent in most mammals, but *Orycteropus* does have this muscle as do many afrotheres, Artiodactyla, Perissodactyla, some Eulipotyphla, and Monotremata. Thus, the muscle seems to be present in members of the groupings

Ungulata and Lipotyphla. M. sternoscapularis is deserving of additional study and verification of homology in these orders.

H. BICEPS GROUP – MUSCULOCUTANEOUS NERVE

Character 26. M. coracobrachialis
(0) absent, (1) one muscle, (2) two muscles, (3) three or more muscles

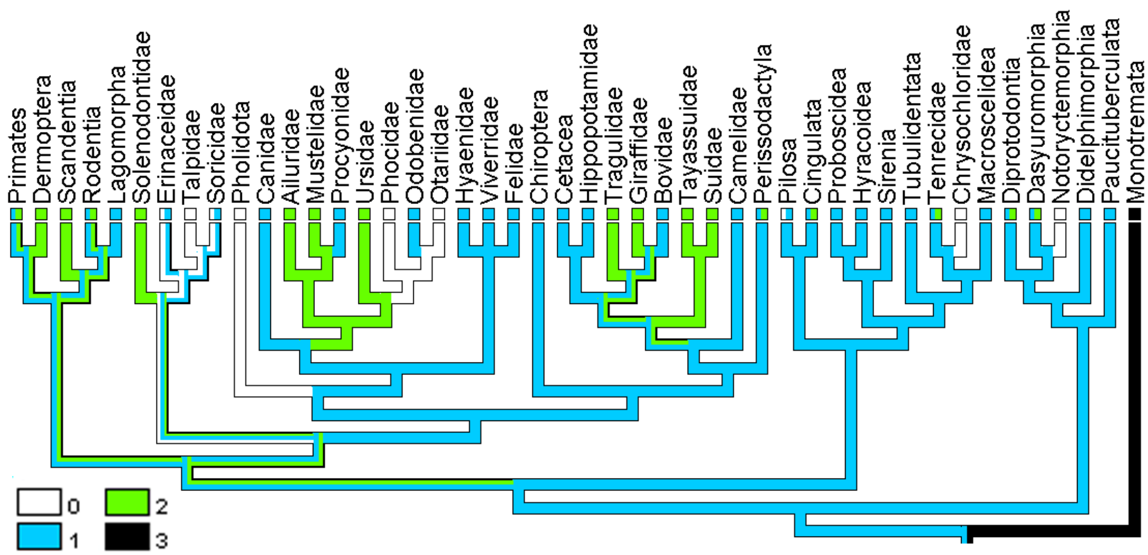


Figure 4.26. Phylogeny depicting number of mm. coracobrachialis.

There are a number of muscles innervated by the musculocutaneus nerve that originate from the coracoid or epicoracoid in monotremes (McKay, 1895), so they are considered to have more than two mm. coracobrachialis here even though I am not certain of the homologies.

In therian mammals, m.coracobrachialis can have two parts: coracobrachialis medius and coracobrachialis profundus (Jouffroy, 1971). M. coracobrachialis medius ("long head") inserts along the distal half of the medial side of the humerus. M.

coracobrachialis profundus ("short head"), sometimes confused with m. articularis humeri, is deep to m. coracobrachialis medius and inserts on the proximal humerus. It is often difficult to determine which coracobrachialis muscle or muscles are present based on the descriptions provided in the literature, and it seems to be fairly variable. Thus, here only the number of mm. coracobrachialis are considered.

There is only one m. coracobrachialis in Didelphidae, *Caenolestes*, and Macropodidae (Coues, 1872; Sidebotham, 1885; Osgood, 1921; Hopwood, 1974; Stein, 1981; Harvey & Warburton, 2010; Warburton, 2011). The same is true in most of the Dasyuromorphia (Macalister, 1870; Cunningham, 1882; MacCormick, 1886; Jones, 1949). In the Phalangeridae there are two parts of the muscle (Cunningham, 1882; Young, 1882; Sonntag, 1922b).

M. coracobrachialis is single in *Orycteropus* and in paenungulates (Murie & Mivart, 1865; Humphry, 1868; Galton, 1870; Murie, 1872a; Miall & Greenwood, 1878a; Anderson, 1883; Windle & Parsons, 1901; Sonntag, 1925; Shindo & Mori, 1956a; Nielsen, 1965; Domning, 1977, 1978; Thewissen & Badoux, 1986). Most tenrecs also have one m. coracobrachialis, but both long and short heads are supposedly found in *Tenrec* and *Setifer* (Dobson, 1882a, 1883; Verheyen, 1961; Jullien, 1967; Neveu & Gasc, 2002). I observed one m. coracobrachialis in all three of the macroscelidids I dissected, although m. coracobrachialis is absent according to Jullien (1967).

M. coracobrachialis is absent in chrysochlorids (Campbell, 1938; Jullien, 1967), the marsupial mole *Notoryctes* (Wilson, 1894; Warburton, 2003), and in all talpids but *Uropsilus* (Dobson, 1882b, 1883; Reed, 1951; Whidden, 2000).

A single m. coracobrachialis is found in *Bradypus* (Macalister, 1869a), but the muscle is absent in *Cyclopes* (Galton, 1869b; Humphry, 1869b). In the Cingulata, there is usually one m. coracobrachialis but there may be two in *Euphractus* (Galton, 1869a; Murie, 1872b; Macalister, 1875a; Miles, 1941).

In *Solenodon*, there are two heads of m. coracobrachialis (Dobson, 1882b; Allen, 1910). A single muscle is found in *Crocidura*, but m. coracobrachialis is absent in the other soricomorphs (Reed, 1951; Sharma, 1958; Gugler, 1959; Jullien, 1967; Neveu & Gasc, 2002). Similarly, one muscle is found in *Erinaceus* but it is absent in *Echinosorex* (Dobson, 1881a, 1882b; Parsons, 1898a; Jullien, 1967; Neveu & Gasc, 2002).

Within Chiroptera, there is one m. coracobrachialis, except in *Eumops* in which the muscle is absent (Humphry, 1869a; Vaughan & Bateman, 1970; Norberg, 1972; Altenbach, 1979; Hermanson & Altenbach, 1983).

In Perissodactyla, there is a single m. coracobrachialis in *Dicerorhinus*, but two in *Equus* and perhaps a poorly divided muscle in *Tapirus* (Murie, 1871; Beddard & Treves, 1889; Sisson, 1914; Campbell, 1936; Bressou, 1961).

There is one m.coracobrachialis in feliforms, Canidae, and Procyonidae, although it is sometimes called articularis humeri (Devis, 1868; Watson & Young, 1879; Allen, 1882; Young & Robinson, 1889; Beddard, 1900; Reighard & Jennings, 1901; Getty, 1975; Spoor & Badoux, 1986a; Feeney, 1999; Julik et al., 2012). There are two parts of m. coracobrachialis in Ursidae, Ailuridae, and Mustelidae (Kelley, 1888; Hall, 1926; Davis, 1964; Leach, 1977; Feeney, 1999; Fisher et al., 2009). The only pinniped with m. coracobrachialis is *Odobenus* (Humphry, 1868; Murie, 1872d; Howell, 1929). M. coracobrachialis is absent in *Manis* (Humphry, 1869; Jouffroy, 1971).

Although this character is not well reported in the artiodactyls, there seems to be a single m. coracobrachialis in *Camelus*, Bovidae, and Hippopotamidae (Windle & Parsons, 1901; Sisson, 1914; Campbell, 1936; Getty, 1975; Smuts & Bezuidenhout, 1987; Fisher et al., 2007), but two parts in Suina and *Giraffa* (Murie, 1872c; Windle & Parsons, 1901; Campbell, 1936; Kneepkins et al., 1989). There seems to be a single m. coracobrachialis in the Cetacea (Carte & Macalister, 1868; Murie, 1873b; Howell, 1930).

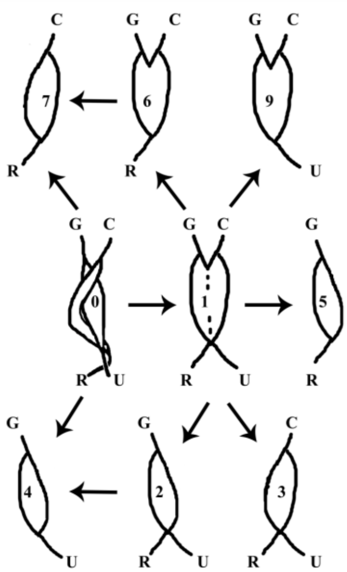
As usual, the situation within Rodentia is mixed, with two parts of m. coracobrachialis found almost as often as a single m. coracobrachialis (Parsons, 1898b; Howell, 1932; Greene, 1935; Young, 1937; Wood & White, 1950; Rinker, 1954; Woods, 1972; McEvoy, 1982; Ryan, 1989; Thorington et al., 1997; Bezuidenhout & Evans, 2005).

There are two parts of m. coracobrachialis in Scandentia, Dermoptera, and most Primates (Owen, 1866; Murie & Mivart, 1872; Dobson, 1881b; Primrose, 1899; Le Gros Clark, 1924, 1926; Woollard, 1925; Beattie, 1927; Davis, 1938; Patterson, 1942; Hill, 1959; Schön, 1968; George, 1977; Soligo, 2005; Diogo & Abdala, 2010). It seems that one of these m. coracobrachialis is lost in some Catarrhini, including *Homo* in which the muscle is pierced by the musculocutaneus nerve (Standring et al., 2005), *Hylobates* (Diogo et al., 2012b), *Mandrillus* (Sonntag, 1922a), and *Rhinopithecus* (Patterson, 1942).

Summary: *Orycteropus* has only one m. coracobrachialis, as do most Marsupialia and Afrotheria. This seems to be primitive for therians. The presence of m. coracobrachialis in *Orycteropus* seems anomalous as most other digging mammals (Pholidota, Chrysochloridae, Talpidae, *Notoryctes*) are lacking m. coracobrachialis.

Euarchontoglires typically have two parts of m. coracobrachialis, and within Laurasiatheria there are one or two parts to the muscle.

Character 27. Mm. biceps brachii - pattern of bony attachment:

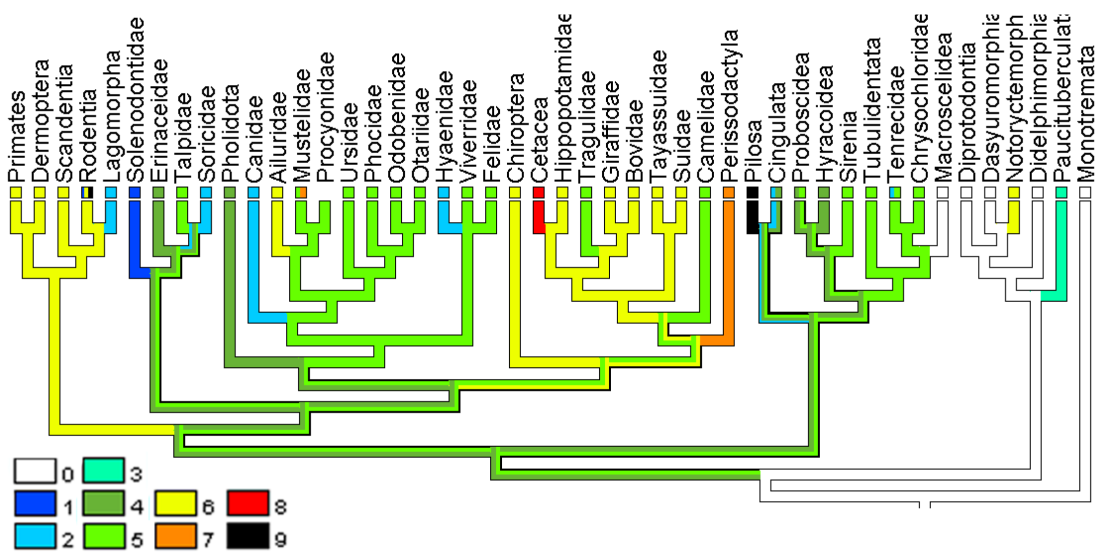


A.

G – glenoid, C – coracoid, R – radius, U – ulna.

Numbers correspond to character states:

0 – Two separable muscle bellies: gleno-ulnar and coraco-radial. Sometimes brief fusion.
1– One belly with two origins (G and C) and two insertions (R and U).
2 – One belly with one origin (G) and two insertions (R and U).
3 – One belly with one origin (C) and two insertions (R and U).
4 – One belly with one origin (G) and one insertion (U).
5 – One belly with one origin (G) and one insertion (R).
6 – One belly with two origins (G and C) and one insertion (R).
7 – One belly with one origin (C) and one insertion (R).
8 – M. biceps brachii is absent.
9 – One belly with two origins (G and C) and one insertion (U)



B.

Figure 4.27. Patterns of mm. biceps brachii origin and insertion A. Possible configurations of mm. biceps brachii (modified from Jullien, 1967). Arrows indicate some of the possible routes of evolution. B. Phylogeny depicting character states of m. biceps brachii.

Again, due to the number of muscles originating from the coracoid or epicoracoid in monotremes, they are only tentatively considered here. Walter (1988) reports two separate biceps brachii muscles in *Tachyglossus*: one inserting on the ulna, and one with two insertions on the radius. Other authors report both heads inserting together on the radius for *Ornithorhynchus* and *Tachyglossus* (Coues, 1870; McKay, 1895; Allen, 1912).

In therian mammals, m. biceps brachii is primitively composed of two distinct bellies, one belly from the coracoid process to the radius ("short head") which spirals around the other belly from the supraglenoid tubercle to the ulna ("long head"). Few mammals retain this primitive state (state 0). Among placentals the primitive state is seen only in Macroscelidea, although there is some fusion between them in *Rhynchocyon* (Jullien, 1967). The coraco-radial belly appears to spiral around the gleno-ulnar belly, and certainly each belly could act independently.

The didelphimorphs have nearly distinct biceps brachii muscles which are fused only briefly in the middle, thus they retain both origins and both insertions (state 0). The coracoid origin has expanded to incorporate the glenoid as well, though a separate origin from the glenoid remains (Coues, 1872; Sidebotham, 1885). The dasyuromorphs and diprotodonts are similar, but often with more fusion between the two bellies (state 1) (Macalister, 1870; Cunningham, 1882; Young, 1882; MacCormick, 1886; Sonntag, 1922b; Jones, 1949; Hopwood, 1974; Harvey & Warburton, 2010; Warburton, 2011). For example, in *Macropus*, the two bellies are not easily separable until the muscle reaches the distal half of the humerus (Hopwood, 1974). In *Caenolestes* (state 3), m. biceps brachii originates from the coracoid and inserts on the radius and around the insertion of brachialis on the ulna (Osgood, 1921). In *Notoryctes* (state 6), both origins are retained but the muscle fuses to insert on the radius (Warburton, 2003).

All afrotheres aside from Macroscelidea retain only the glenoid origin. *Potamogale*, *Setifer*, *Tenrec*, and *Dugong* have retained both the radial and ulnar insertions (state 2) (Dobson, 1882a, 1883; Vereheyen, 1961; Jullien, 1967; Domning, 1977). *Orycteropus*, chrysochlorids, *Microgale*, and *Trichechus* have only the radial insertion (state 5) (Humphry, 1868; Galton, 1870; Murie, 1872a; Dobson, 1882a, 1883; Sonntag, 1925; Jullien, 1967; Puttick & Jarvis, 1977; Domning, 1978). Hyracoidea has only the ulnar insertion (state 4) (Murie & Mivart, 1865; Windle & Parsons, 1901). It is unclear whether *Elephas* has radial or ulnar insertion, as both are reported (Miall & Greenwood, 1878a; Anderson, 1883; Shindo & Mori, 1956a; Nielsen, 1965; Jouffroy, 1971). In Afrotheria except Macroscelidea, m. biceps brachii probably primitively originated from the glenoid and inserted on both the radius and ulna (state 2). This hypothesis is bolstered by the observations of Humphry (1868) who noted a few fibers of m. biceps brachii passing with m. brachialis to the ulna in *Orycteropus* (although I did not observe this), and Campbell (1938) refered to m. biceps brachii inserting on both the radius and ulna in *Chrysospalax*.

Xenarthrans have mixed descriptions in the literature. Most often, m. biceps brachii has a glenoid origin and inserts on the ulna (state 4) (Humphry, 1869b; Macalister, 1869a, 1873). In *Bradypus*, *Dasypus*, and *Tolypeutes*, both origins may be retained (state 9) (Humphry, 1869b; Murie, 1872b; Miles, 1941). In *Cyclopes* and *Euphractus*, the insertion may be on the radius and ulna (state 2) (Galton, 1869a, 1869b; Humphry, 1869b; Macalister, 1875a).

M. biceps brachii in the Erinaceidae originates from the glenoid and inserts on the ulna (state 4) (Dobson, 1881a, 1882b; Parsons, 1898a; Neveu & Gasc, 2002), while the Soricidae retain the radial insertion as well (state 2) (Reed, 1951; Sharma, 1958; Gugler, 1959; Jullien, 1967; Neveu & Gasc, 2002). The eulipotyphlan *Solenodon cubanus* has both glenoid and coracoid origins and both radial and ulnar insertions (state 1) (Dobson, 1882b; Allen, 1910; Jullien, 1967). The Talpidae have a single belly of m. biceps brachii that originates from the glenoid and inserts on the radius (state 5) (Dobson, 1883; Reed, 1951; Jullien, 1967; Whidden, 2000)

Within Chiroptera, some bats have two coracoid origins and two radial insertions, a derived condition (Humphry, 1869a; Norberg, 1972; Hermanson & Altenbach, 1983). Others have one coracoid and one glenoid origin, and a single insertion on the radius (state 6), which is the configuration used to score the character for the order (Vaughan, 1959; Vaughan & Bateman, 1970; Altenbach, 1979).

Perissodactyla have a single belly of m. biceps brachii from the coracoid process to the neck of the radius (state 7) (Murie, 1871; Beddard & Treves, 1889; Windle & Parsons, 1901; Bressou, 1961). In *Tapirus*, there may be an insertion on the ulna as well (state 3) (Campbell, 1936; Bressou, 1961).

M. biceps brachii extends from the glenoid to the radius in Felidae, Viverridae, *Ailuropoda*, and pinnipeds (state 5) (Humphry, 1868; Murie, 1872d; Mivart, 1882; Reighard & Jennings, 1901; Davis, 1964; Julik et al., 2012). There is also an insertion on the ulna (state 2) in the Hyaenidae and Canidae and in one description of *Felis* (Watson & Young, 1879; Young & Robinson, 1889; Getty, 1975; Spoor & Badoux, 1986a; Feeney, 1999). In *Ailurus*, the muscle has both glenoid and coracoid origins and inserts on the radius (state 6) (Fisher et al., 2009). Reports are mixed for the Mustelidae, with a single origin from either the coracoid or glenoid, and an insertion on the radius (Hall, 1926; Fisher, 1942; Leach, 1977). The origin is from the glenoid only and insertion on the ulna in *Manis* (state 4) (Jouffroy, 1971).

Artiodactyla also show some variation in descriptions of m. biceps brachii, perhaps because the supraglenoid tubercle and coracoid are not far separated. The coracoid origin seems to be absent, however (Jouffroy, 1971). In *Camelus* and *Tragulus*, the muscle originates from the glenoid and inserts on the radius (state 5) (Windle & Parsons, 1901; Smuts & Bezuidenhout, 1987). In the Suina, Bovidae, and Hippopotamidae, the muscle originates from the glenoid and often inserts on both radius and ulna (state 2) (Sisson, 1914; Campbell, 1936; Getty, 1975; Kneepkins et al., 1989; Fisher et al., 2007). The muscle is absent or consists only of extremely vestigial fibers in Cetacea (state 8) (Murie, 1873b; Howell, 1930; Cooper et al., 2007).

In rodents, as usual, there is no consistent pattern. Generally, m. biceps brachii retains both glenoid and coracoid origins, with the heads fusing, and then inserting predominantly on the ulna (state 9) (Howell, 1932; Wood & White, 1950; Rinker, 1954; Woods, 1972; McEvoy, 1982; Stein, 1986; Ryan, 1989). When there is also a smaller insertion on the radius (state 1), the tendon of insertion of m. brachialis passes between the two tendons of insertion of m. biceps brachii (Woods, 1972). The muscle often, however, inserts solely on the radius (state 6) (Parsons, 1898b; Greene, 1935; Rinker, 1954; Thorington et al., 1997; Bezuidenhout & Evans, 2005). In Lagomorpha m. biceps brachii extends from the glenoid to the radius and ulna (state 2) (Bensley, 1921; Crabb, 1931; Craigie, 1966).

Scandentia and Primates retain both glenoid and coracoid origins of m. biceps brachii. The bellies fuse about midshaft in most primates and insert on the tuberosity of the radius (state 6) (Owen, 1866; Murie & Mivart, 1872; Primrose, 1899; Sonntag, 1922a; Le Gros Clark, 1924, 1926; Woollard, 1925; Beattie, 1927; Davis, 1938; Patterson, 1942; Miller, 1952; Hill, 1959; Schön, 1968; George, 1977; Soligo, 2005; Standring et al., 2005). The muscle is the same in Dermoptera (Champneys, 1871).

Generally the tendon of origin of the "long head" of m. biceps brachii passes through the shoulder joint capsule. However, it does not do so in all mammals. In *Orycteropus* (Jouffroy, 1971), *Didelphis* (Coues, 1872), *Bradypus* (Macalister, 1876), *Tapirus* (Campbell, 1936), *Equus* (Windle & Parsons, 1901), *Choeropsis* (Campbell, 1936), *Talpa* (Jouffroy, 1971), and *Pteropus* (Humphry, 1869a) it does not pass through the joint capsule. The significance of this is unknown, but "in mammals the two heads may fuse and origins of this fused head or of either single head may shift their locations" (Reed, 1951). Embryological study of the envelopment of the tendon of m. biceps brachii in the joint capsule indicates a wide diversity of arrangements (Jouffroy, 1971).

<u>Functional implications of biceps attachment</u>

M. biceps brachii has a single tendon of insertion into the radius in many fossorial mammals– *Notoryctes*, *Orycteropus*, chrysochlorids, and talpids– but an ulnar insertion in *Dasypus* and *Manis*. In addition, the long tendon of origin does not pass through the joint capsule, but travels through an osseous tunnel or deep to an extremely strong transverse humeral ligament (Jouffroy, 1971). A single insertion into the radius is also seen in arboreal mammals – Primates, Scandentia. One tendon inserting into the radius may increase the force of flexion at the elbow and strengthen supination. In cursorial mammals, the tendon inserts variably on either the radius or ulna or both. This may be the result of the fusion of the bones of the forearm in cursorially adapted mammals.

Summary: *Orycteropus* and many other afrotheres have m. biceps brachii attaching on the glenoid and the radius. Such consistency of attachments within the clade is remarkable given the diversity of possible configurations. Also sharing the same configuration of m. biceps brachii are Talpidae and some Carnivora and Artiodactyla.

Character 28. M. brachialis
Absent (0), inserts on the ulna (1), inserts on the radius or both forearm bones (2)

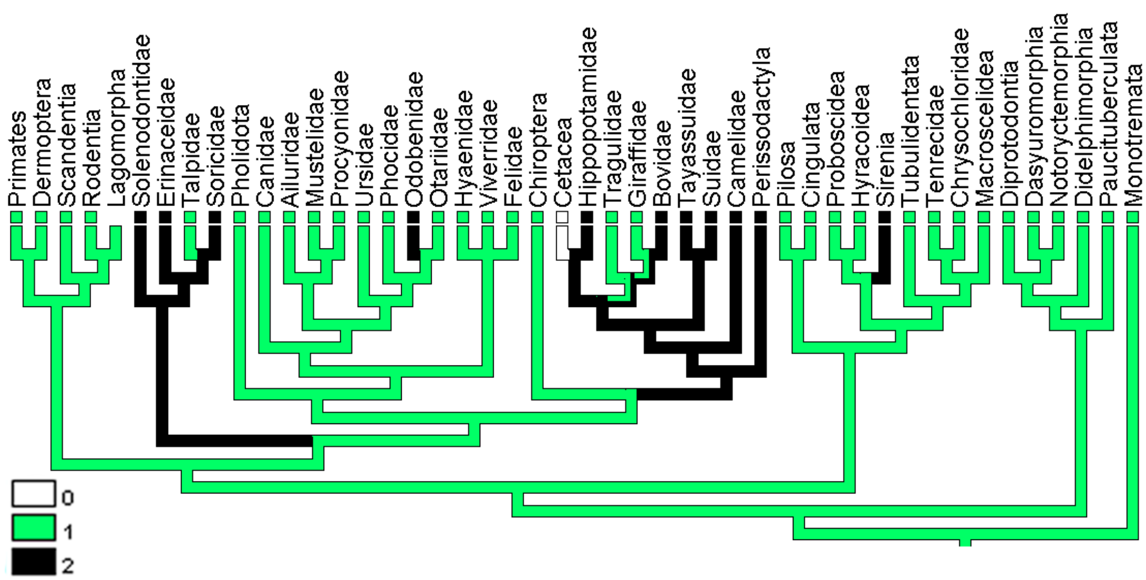


Figure 4.28Phylogeny depicting character states of m. brachialis.

In many mammals m. brachialis originates along the caudal side of the neck of the humerus between the greater and lesser tuberosities, attaching even to the gleno-humeral joint capsule, and spirals around the shaft of the humerus infero-lateral to the deltoid crest. This is the condition in marsupials and in *Orycteropus* and other afrotheres, for example (Macalister, 1870). This is in sharp contrast to the origin in humans and other primates, which is from the distal cranio-lateral aspect of the humerus (Primrose, 1899; Sonntag, 1922a; Patterson, 1942; Miller, 1952; Schön, 1968; Soligo, 2005; Standring et al., 2005). Other mammals, such as Carnivora, have an intermediate origin from the proximal lateral humerus (Julik et al., 2012). This gradient is difficult to quantify based on the literature, and has thus not been scored as a character. I think it would be a useful character if better descriptions and images were available.

The insertion is fairly constantly on the ulna, often in conjunction with or surrounded by the tendons of m. biceps brachii (Jouffroy, 1971). M. brachialis inserts on the ulna in Monotremata (Mivart, 1866; Coues, 1870; Allen, 1912; Walter, 1988). It also has an ulnar insertion in Marsupialia, generally in conjunction with the gleno-ulnar portion of m. biceps brachii (Macalister, 1870; Coues, 1872; Cunningham, 1882; Young, 1882; Sidebotham, 1885; Wilson, 1894; Parsons, 1896b; Osgood, 1921; Sonntag, 1922b; Jones, 1949; Hopwood, 1974; Stein, 1981; Harvey & Warburton, 2010; Warburton, 2003, 2011).

In afrotheres except Sirenia, the muscle inserts on the ulna (Murie & Mivart, 1865; Humphry, 1868; Miall & Greenwood, 1878a; Dobson, 1882a, 1883; Parsons, 1901; Windle & Parsons, 1901; Sonntag, 1925; Verheyen, 1961; Nielsen, 1965; Jullien, 1967; Puttick & Jarvis, 1977; Thewissen & Badoux, 1986; Neveu & Gasc, 2002). This is what I observed in my afrothere dissections. There are a few reports of both radial and ulnar insertions in *Chrysospalax* (Campbell, 1938) and *Potamogale* (Jullien, 1967), and only a radial insertion in *Elephas* (Shindo & Mori, 1956a) and Sirenia (Domning, 1977, 1978; Murie, 1872a). The muscle is described as absent in some chrysochlorids (Dobson, 1883; Gasc et al., 1986).

Within Eulipotyphla, m. brachialis has mixed reports of insertion. In Erinaceidae, it may insert on either radius or ulna even within the same species (Dobson, 1882b; Parsons, 1898a; Jullien, 1967; Neveu & Gasc, 2002). In Soricidae, the muscle sometimes inserts on both radius and ulna (Reed, 1951; Sharma, 1958), and sometimes just ulna (Jullien, 1967; Neveu & Gasc, 2002). In talpids it has ulnar insertion (Dobson, 1883; Reed, 1951; Jullien, 1967; Whidden, 2000). In *Solenodon*, it has radial insertion (Allen, 1910).

Xenarthrans have an insertion on the ulna (Galton, 1869a, 1869b; Humphry, 1869b; Murie, 1872b; Macalister, 1875a; Miles, 1941).

M. brachialis inserts on the ulna in Primates, Dermoptera, Scandentia, and Rodents (Owen, 1866; Murie & Mivart, 1872; Champneys, 1871; Parsons, 1898b; Primrose, 1899; Sonntag, 1922a; Le Gros Clark, 1924, 1926; Woollard, 1925; Beattie, 1927; Howell, 1932; Greene, 1935; Young, 1937; Davis, 1938; Patterson, 1942; Wood & White, 1950; Miller, 1952; Rinker, 1954; Hill, 1959; Schön, 1968; Woods, 1972; George, 1977; McEvoy, 1982; Stein, 1986; Ryan, 1989; Thorington et al., 1997; Bezuidenhout & Evans, 2005; Soligo, 2005; Standring et al., 2005).

In Carnivora and *Manis*, the insertion is also on the ulna (Devis, 1868; Humphry, 1868, 1869; Murie, 1872d; Watson & Young, 1879; Allen, 1882; Young & Robinson, 1889; Reighard & Jennings, 1901; Hall, 1926; Howell, 1929; Fisher, 1942; Davis, 1964;

Leach, 1977; Feeney, 1999; Fisher et al., 2009; Julik et al., 2012). The only reports of a radial insertion are for *Canis* and *Felis* (Getty, 1975), and *Odobenus* (Murie, 1872d).

In Artiodactyla, the insertion may be either radius or ulna or both, perhaps due to the fusion of the bones, as may be the case with the mixed insertion of m. biceps brachii (Murie, 1872c; Windle & Parsons, 1901; Beddard, 1909; Sisson, 1914; Campbell, 1936; Getty, 1975; Smuts & Bezuidenhout, 1987; Kneepkins et al., 1989; Fisher et al., 2007).

M. brachialis is absent in Cetacea (Cooper et al., 2007).

In Perissodactyla, the insertion of m. brachialis may be on the radius (Murie, 1871; Sisson, 1914) or on both the radius and ulna, as in *Tapirus* (Campbell, 1936; Bressou, 1961).

Chiropterans have radial insertion of m. brachialis in Pteropodidae (Humphry, 1869a; Norberg, 1972), and ulnar insertion in other bats (Vaughan, 1959; Altenbach, 1979; Hermanson & Altenbach, 1983).

Summary: *Orycteropus* and afrotheres except Sirenia have the primitive state of m. brachialis inserting on the ulna, different from the radial insertion noted for most Eulipotyphlans, Artiodactyla, and Perissodactyla.

Character 29. Accessory muscle in cranial aspect of the arm? – "m. cubitalis"
Absent (0), present (1)

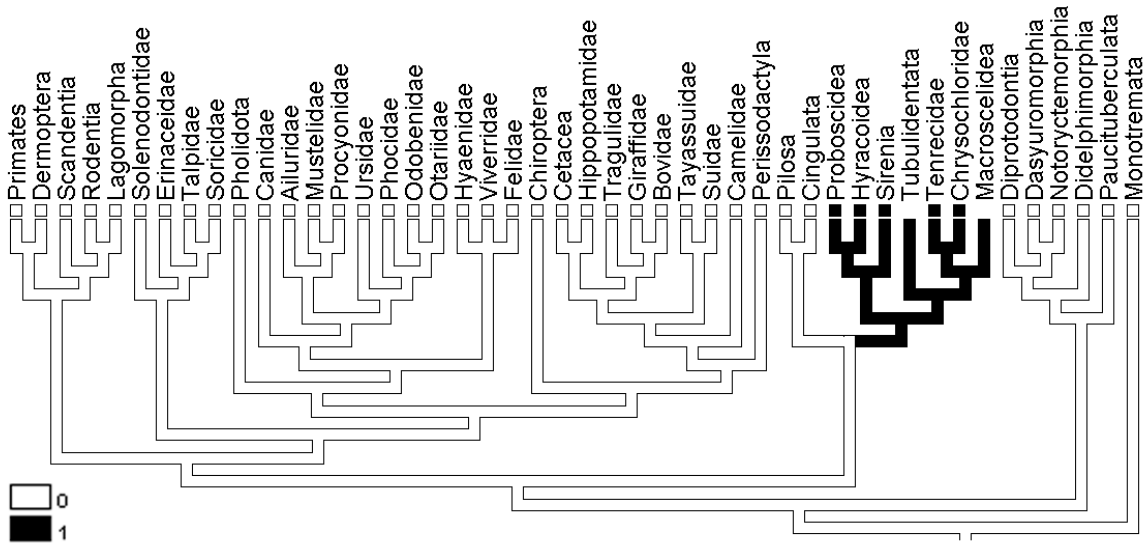


Figure 4.29Phylogeny depicting presence of m. cubitalis.

In some afrotheres, just medial to the insertion of m. brachialis, there is an additional small slip of muscle of unknown origin spanning the cubital fossa from the distal cranial aspect of the humerus to the ulna. The muscle is independent at origin and insertion and no nerve supply was readily determined. This slip of muscle is here named **m. cubitalis**. I found m. cubitalis in *Microgale*, *Calcochloris*, and the hyracoids. In *Calcochloris*, it coexists with what appears to be dual heads of origin of m. brachialis, indicating that these are likely two separate characters. M. cubitalis was present in one of my elephant shrew specimens (*Rhynchocyon*), but was believed to be of no significance at the time and was removed without any information recorded. The "supinator longus" of Murie & Mivart (1865) and the "distinct short head" of m. brachialis reported by Windle & Parsons (1901) probably represent this same additional muscle in *Procavia.* Domning (1978) noted a similar structure he termed a "check ligament" in *Trichechus*, and Miall & Greenwood (1878a) record similar observations for *Elephas*. I suspect that these comments all refer to this vestigial slip of muscle, which, to my knowledge, is not observed in monotremes, marsupials, or any other eutherian mammal. There is, in addition to m. brachioradialis, a "humeral portion" of m. biceps brachii originating from the cranial humerus and inserting on the radius in *Bradypus* (Humphry, 1869b; Macalister, 1869a). This muscle is probably not homologous with either m. cubitalis or with an extra head of m. brachialis, given its insertion on the radius. M. cubitalis merits further study of developmental origin and innervation; it is possible that this could be a vestigial m. brachioradialis, or it could potentially be a unique morphological character that unites Afrotheria.

Summary: M. cubitalis is potentially a very significant myological feature which I observed in Afrosoricida and Hyracoidea and suspect is present in the other paenungulates and macroscelidids. Dissection of a new *Orycteropus* specimen in Germany in collaboration with Dr. Thomas Lehmann (Frankfurt) will offer another chance to look for m. cubitalis in that genus.

I. SPINATI GROUP – SUPRASCAPULAR NERVE

Character 30. M. supraspinatus
Inserts on greater tuberosity (0), on lesser and greater tuberosities (1)

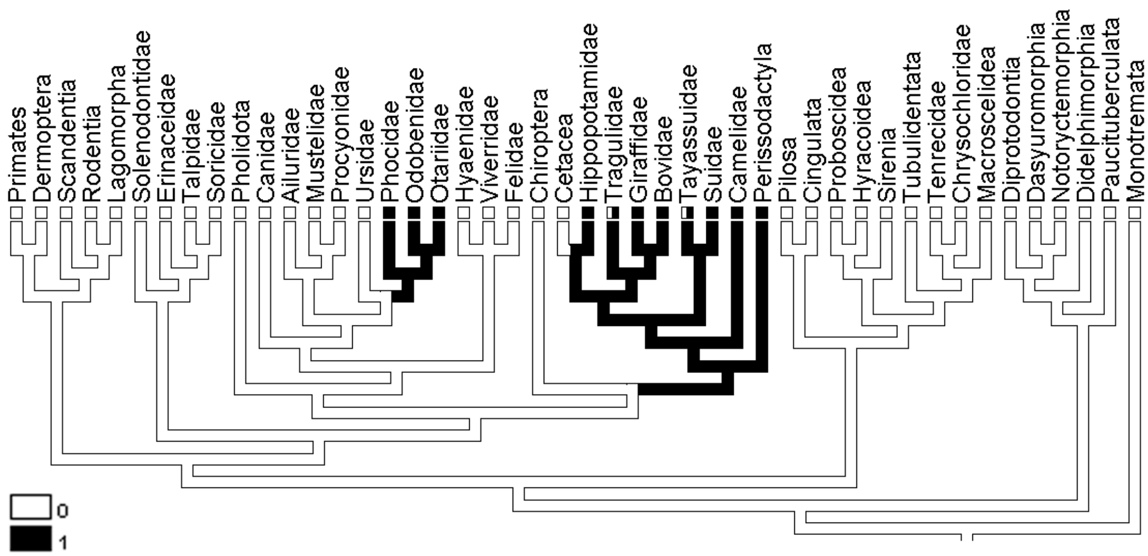


Figure 4.30Phylogeny depicting character states of m. supraspinatus.

Mm. supraspinatus and infraspinatus share innervation and are derived from the same muscle mass (Jouffroy, 1971). Due to the different homologies of the bony features of the pectoral girdle, the two muscles are difficult to interpret in Monotremata (Mivart, 1866; Allen, 1912; Walter, 1988). Aside from this structural difference, mm. supraspinatus and infraspinatus have few features of interest. Sometimes they are described as partially subdivided, for example, m. supraspinatus in phocids (Howell, 1929), and m. infraspinatus in *Mandrillus* (Sonntag, 1922a). In artiodactyls there may be a cartilaginous sesamoid in the tendon of insertion of m. supraspinatus (Jouffroy, 1971). M. infraspinatus may be absent in *Talpa* (Jullien, 1967; Whidden, 2000).

The one character considered for these two muscles is that m. supraspinatus inserts on both greater and lesser tuberosities in Perissodactyla, Artiodactyla, and pinnipeds (Murie, 1872c, 1872d; Windle & Parsons, 1901; Beddard, 1909; Sisson, 1914; Howell, 1929; Campbell, 1936; Getty, 1975; Fisher et al., 2007). M. supraspinatus has the typical insertion on only the greater tuberosity in *Orycteropus* and other mammals.

Summary: The configuration of m. supraspinatus in *Orycteropus* is the primitive state shared with most mammals except Artiodactyla, Perissodactyla, and pinnipeds.

J. TRICEPS GROUP – RADIAL NERVE

Character 31. M. dorso-epitrochlearis[16]

Absent (0), origin from only m. latissimus dorsi (1), origin includes m. teres major or scapula (2)

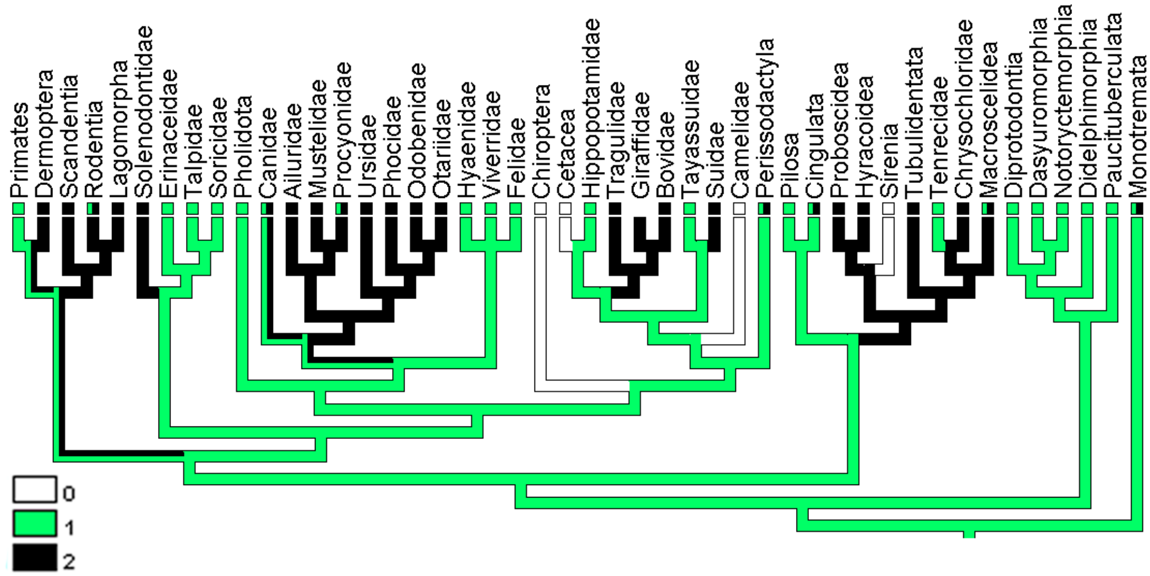


Figure 4.31 Phylogeny depicting character states of m. dorso-epitrochlearis.

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[16] anconeus accessorius, anconeus quartus, dorso-antébrachial, dorso-olécranien, extensor cubiti, extensor antebrachii parvus, latissimo-olecranialis, latissimo-tricipitalis, omo-anconeus, scapulo-olécranien, tensor fasciae antebrachii

The ribbon-like m. dorso-epitrochlearis typically takes origin from m. latissimus dorsi and inserts on the medial side of the olecranon process (Jouffroy, 1971). This strange muscle is not typically found in humans and has received a myriad of names in the literature. It is called "tensor fasciae antebrachii" in the *Nomina Anatomica Veterinaria* (2005), as it is more attached to the forearm fascia in the domesticated cursorial mammals. However, it most often inserts on the medial surface of the olecranon, so I have used the term m. dorso-epitrochlearis, which is commonly employed in the literature.

Some believe that m. dorso-epitrochlearis is derived from m. latissimus dorsi (Cheng, 1955). Windle & Parsons (1901) proposed that a connection between m. dorso-epitrochlearis and m. panniculus carnosus in *Sus* might indicate a derivation from that muscle layer, despite stating that m. dorso-epitrochlearis has either radial or axillary nerve innervation, which is not compatible with m. panniculus carnosus. However, it has also been suggested that m. dorso-epitrochlearis evolved from a part of mm. triceps brachii and not as a small subdivision of m. latissimus dorsi (Diogo et al., 2009; Diogo & Abdala, 2010). This is probable for two reasons: its radial nerve innervation and an origin including either m. teres major or the scapula in many mammals.

Radial nerve innervation is recorded for a wide variety of mammals: the marsupial *Petrogale* (Parsons, 1896b), the afrothere *Calcochloris*, the xenarthran *Dasypus* (Miles, 1941), soricids (Reed, 1951), perissodactyls *Equus* and *Tapirus* (Sisson, 1914; Campbell, 1936), *Canis* (Budras, 2007), the tree shrew *Tupaia* (Le Gros Clark, 1924), rodents *Marmota* and *Proechimys* (Woods, 1972; Bezuidenhout & Evans, 2005), and primates *Rhinopithecus* and *Pan* (Champneys, 1871; Patterson, 1942; Miller, 1952).

However, Cheng (1955) claimed innervation of m. dorso-epitrochlearis to be via subscapular nerves in the opossum, and it is supplied by both radial and subscapular nerves in monotremes (Jouffroy et al., 1971). Howell (1932, 1937) acknowledges radial nerve innervation of m. dorso-epitrochlearis but believes the innervation has shifted "in response to the law of fasciculation." I do not agree, because m. dorso-epitrochlearis seems to be grouped functionally and by innervation with mm. triceps brachii, and the fibers of origin of m. dorso-epitrochlearis do not flow from m. latissimus dorsi (Diogo & Abdala, 2010). For example, in *Cyclopes*, m. dorso-epitrochlearis takes origin from m. latissimus dorsi but "appears to be tacked on to its outer edge by a kind of faint tendinous seam" (Galton, 1869b). The muscle fibers never appear to be continuous; the fibers of m. dorso-epitrochlearis are nearly perpendicular to the fibers of m. latissimus dorsi. Alternatively, m. dorso-epitrochlearis can take origin from m. teres major or the scapula.

In *Tachyglossus*, m. dorso-epitrochlearis originates from both the caudal angle of the scapula and the teres major (Mivart, 1866; Walter, 1988). In *Zaglossus*, the origin is from the neck of the scapula (Allen, 1912). However, in *Ornithorhynchus*, the muscle originates only from m. latissimus dorsi (Coues, 1870; McKay, 1895). In marsupials, the muscle originates consistently from m. latissimus dorsi (Macalister, 1870; Coues, 1872; Cunningham, 1882; Young, 1882; Sidebotham, 1885; MacCormick, 1886; Osgood, 1921; Sonntag, 1922b; Jones, 1949; Hopwood, 1974; Jenkins & Weijs, 1979; Stein, 1981; Harvey & Warburton, 2010; Warburton, 2011).

In *Orycteropus*, m. dorso-epitrochlearis takes origin from the caudal angle of the scapula and from m. latissimus dorsi (Humphry, 1868; Galton, 1870). Sonntag (1925) also notes an origin from m. teres major, but I did not observe this.

There is also an origin from the caudal angle of the scapula in chrysochlorids (Parsons, 1901; Gasc et al., 1986), although it is often confused with a portion of mm. triceps brachii (Campbell, 1938; Jullien, 1967). The muscle was distinct in my specimen of *Calcochloris*. Others have described a typical origin from m. latissimus dorsi and an insertion on the "third bone" of the forearm, the ossified tendon of m. flexor digitorum profundus (Dobson, 1883; Puttick & Jarvis, 1977). More dissections would be beneficial.

In the Tenrecidae the muscle originates consistently from m. latissimus dorsi (Dobson, 1882a, 1883; Verheyen, 1961; Jullien, 1967; Neveu & Gasc, 2002).

In macroscelidids, m. dorso-epitrochlearis originates partly from m. teres major in *Petrodromus* and *Rhynchocyon* but only from m. latissimus dorsi in *Elephantulus* and *Macroscelides* (Jullien, 1967).

In hyracoids, m. dorso-epitrochlearis originates partly from the fascia of m. infraspinatus and partly from m. latissimus dorsi (Murie & Mivart, 1865; Windle & Parsons, 1901). I also noted a connection with m. panniculus carnosus in *Procavia*.

In *Elephas,* m. dorso-epitrochlearis takes partial or complete origin from the caudal angle of the scapula (Miall & Greenwood, 1878a; Windle & Parsons, 1901; Shindo & Mori, 1956a; Nielsen, 1965). M. dorso-epitrochlearis is absent in Sirenia (Domning, 1977, 1978), or perhaps is represented by the "distinct fleshy slip which passes from latissimus dorsi to teres major at tendon of insertion" (Murie, 1872a).

In Xenarthra, m. dorso-epitrochlearis tends to originate from m. latissimus dorsi (Galton, 1869b; Humphry, 1869b; Macalister, 1875a; Miles, 1941), but there are references to an attachment to the caudal angle of the scapula in Cingulata (Galton, 1869a; Humphry, 1869b; Murie, 1872b).

Among Eulipotyphla, the muscle originates partly from m. teres major in solenodontids (Dobson, 1882b; Allen, 1910; Jullien, 1967). Otherwise the muscle originates from m. latissimus dorsi (Dobson, 1881a, 1882b, 1883; Reed, 1951; Sharma, 1958; Gugler, 1959; Jullien, 1967; Neveu & Gasc, 2002; Whidden, 2000). M. dorso-epitrochlearis is absent in Chiroptera (Howell, 1937; Jouffroy, 1971).

In *Equus* and *Tapirus*, m. dorso-epitrochlearis originates from the the caudal border of the scapula and m. latissimus dorsi (Windle & Parsons, 1901; Sisson, 1914; Campbell, 1936). In *Dicerorhinus*, the muscle originates solely from m. latissimus dorsi (Beddard & Treves, 1889).

The muscle originates from m. latissimus dorsi in *Manis* (Humphry, 1869b) and in the feliform Carnivora (Devis, 1868; Young & Robinson, 1889; Reighard, & Jennings, 1901; Getty, 1975; Julik et al., 2012). In the caniform Carnivora, the origin of the muscle is more varied. It has a typical origin from m. latissimus dorsi in many species (Allen, 1882; Hall, 1926; Feeney, 1999), takes origin from m. triceps brachii caput longum in *Canis* (Getty, 1975), from mm. latissimus dorsi and panniculus carnosus in *Ailuropoda* (Davis, 1964), from mm. latissimus dorsi and teres major in *Ailurus*, *Martes*, and *Bassaricyon* (Beddard, 1900; Hall, 1926; Feeney, 1999; Fisher, 2009), and from the caudal angle of the scapula or mm. latissimus dorsi and triceps brachii caput longum in pinnipeds (Humphry, 1868; Murie, 1872d; Howell, 1929).

In the Artiodactyla, the origin is also quite varied. For example, in the Suidae and Tragulidae, the origin is variously described as from the caudal border of the scapula, from both mm. latissimus dorsi and teres major, and from the fascia of m. infraspinatus, differing even within genus (Windle & Parsons, 1901; Campbell, 1936; Kneepkins et al., 1989). The muscle originates from the scapula or m. triceps brachii caput longum in the Bovidae (Sisson, 1914; Getty, 1975). Many artiodactyls have the typical origin from m. latissimus dorsi (Windle & Parsons, 1901; Beddard, 1909; Campbell, 1936). The muscle is absent in *Camelus* (Smuts & Bezuidenhout, 1987) and in Cetacea (Howell, 1937).

In rodents there are also various origins recorded for m. dorso-epitrochlearis: it may originate from the tendon of m. teres major (Ryan, 1989), from both mm. teres major and latissimus dorsi (Howell, 1932; Thorington et al., 1997; Bezuidenhout & Evans, 2005), from m. latissimus dorsi only (Greene, 1935; Rinker, 1954; Woods, 1972; McEvoy, 1982; Stein, 1986), from the humerus (Wood & White, 1950), or from the scapula (Howell, 1932). In Lagomorpha m. dorso-epitrochlearis originates from the fascia at the medial humerus (Bensley, 1921; Craigie, 1966).

In Scandentia, the origin is from both mm. latissimus dorsi and teres major (Le Gros Clark, 1924, 1926; Davis, 1938; George, 1977). In Primates, it originates only from m. latissimus dorsi (Owen, 1866; Murie & Mivart, 1872; Dobson, 1881b; Primrose, 1899; Beddard, 1891; Woollard, 1925; Beattie, 1927; Patterson, 1942; Miller, 1952; Hill, 1959; Schön, 1968; Soligo, 2005). In humans, it is typically absent but a fibrous slip may pass from the tendon of m. latissimus dorsi to m. triceps brachii caput longum which presumably represents m. dorso-epitrochlearis (Standring et al., 2005).

Summary: An origin of m. dorso-epitrochlearis from the scapula, as seen in *Tachyglossus*, *Orycteropus*, *Calcochloris*, *Elephas*, *Equus* and *Tapirus*, Dasypodidae, pinnipeds, and possibly a few artiodactyls, seems to be the primitive state. In other afrotheres the origin has shifted to nearby musculature. Tenrecidae, however, is like most of Eulipotyphla, Marsupialia, and Primates with a typical m. dorso-epitrochlearis originating only from m. latissimus dorsi.

Character 32. M. triceps brachii caput longum

Single origin (0), two heads of origin (1), accessory humeral head (2)

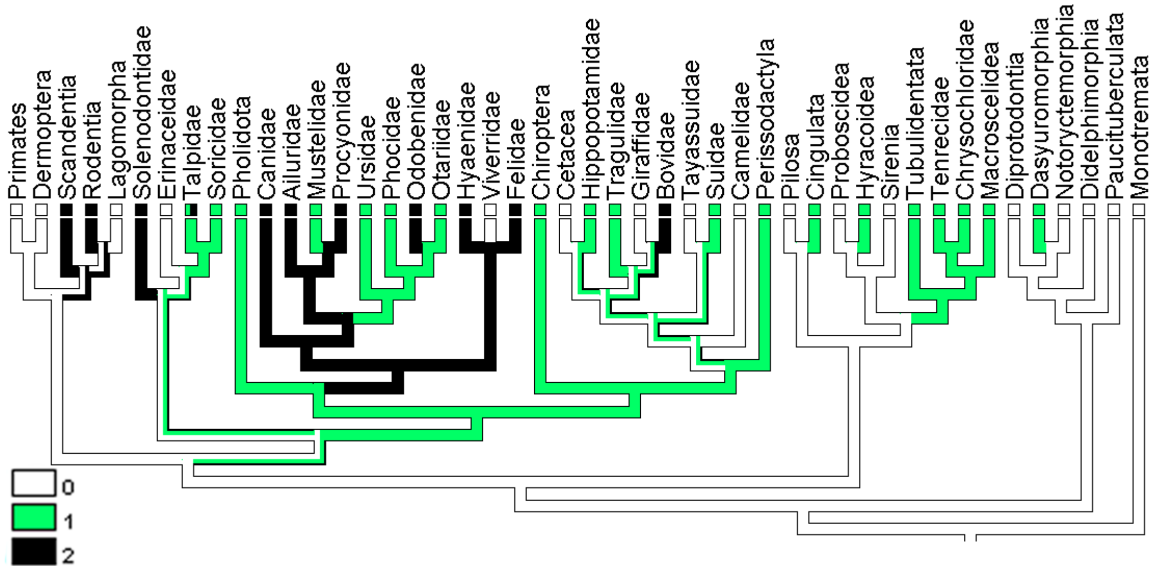

Figure 4.32 Phylogeny depicting character states of m. triceps brachii caput longum.

There is one scapular head of m. triceps brachii in Monotremata (Mivart, 1866; Coues, 1870; McKay, 1895; Allen, 1912; Walter, 1988). Of all the marsupials, only *Thylacinus* has been described as having two scapular heads of triceps brachii: one head with a "tendinous origin" from near the glenoid and another with a "fleshy origin" from the caudal border of the scapula (Cunningham, 1882).

The dual heads of m. triceps brachii caput longum seem to have been ignored in most descriptions of afrothere myology, but these were quite clearly separate origins in my dissections. As in *Thylacinus*, there is one head with a more tendinous origin from the neck of the scapula, and another head with a more extensive fleshy origin along the caudal border of the scapula. There is some fusion of the two heads near their insertion in *Orycteropus* (Sonntag, 1925). I observed two distinct scapular heads in *Calcochloris*, although the muscle is described as undivided in *Chrysochloris* (Jullien, 1967). There are also two distinct scapular heads in *Microgale* and *Micropotamogale*, but there is only a single fused head in *Potamogale* (Verheyen, 1961; Jullien, 1967). There are two heads of origin in the Macroscelidea (Jullien, 1967), and two heads of origin in the Hyracoidea that fuse not long after origin similar to the m. triceps brachii caput longum in artiodactyls. No divisions are described for Proboscidea or Sirenia (Murie, 1872a; Miall & Greenwood, 1878a; Shindo & Mori, 1956a; Nielsen, 1965; Domning, 1977, 1978).

Within Xenarthra, there are at least two heads of m. triceps brachii originating from the scapula in the Cingulata (Galton, 1869a; Macalister, 1875a). The condition in Pilosa is unclear given the scanty descriptions of mm. triceps brachii.

There are frequently two scapular origins of m. triceps brachii described for eulipotyphlans (Dobson, 1883, for *Desmana*; Reed, 1951, for *Neurotrichus*; Sharma, 1958, for *Suncus*; Gugler, 1959, for *Cryptotis*; Jullien, 1967, for *Talpa*). Occasionally an extra head of origin from the humerus is described, which could be a displaced second origin of m. triceps brachii caput longum (Dobson, 1883, for *Condylura*; Allen, 1910, for *Solenodon*).

There are two origins of m. triceps brachii caput longum in some Chiroptera (Vaughan & Bateman, 1970; Hermanson & Altenbach, 1983). Two are also observed in *Manis* (Humphry, 1869b). At least two are observed in *Tapirus* (Campbell, 1936). Two semi-distinct scapular heads of m. triceps brachii have been reported in artiodactyls

(Windle & Parsons, 1901; Beddard, 1909; Campbell, 1936). I observed this in both *Pecari* and *Tragulus*, and a similar configuration in the hyracoids.

In Carnivora, two origins of m. triceps brachii caput longum are described for *Ailuropoda* and pinnipeds, and a special "caput anguli" from the caudal angle of the scapula in some mustelids (Hall, 1926; Howell, 1929; Davis, 1964; Leach, 1977; Feeney, 1999). In the other Carnivora, there is only a single head of m. triceps brachii caput longum. However, an accessory head originating from the caudal humerus, "triceps brachii caput accessorium" is often observed (Murie, 1872d; Beddard, 1900; Reighard & Jennings, 1901; Getty, 1975; Spoor & Badoux, 1986a; Feeney, 1999; Fisher et al., 2009; Julik et al., 2012). This may be a shifted origin of the second head of m. triceps brachii caput longum.

In rodents, there is a single origin of m. triceps brachii caput longum from the scapula, but often an accessory humeral head (Woods, 1972; McEvoy, 1982; Bezuidenhout & Evans, 2005). The same is true of Scandentia (Le Gros Clark, 1924, 1926; Endo, 1999). Primates have a single origin of m. triceps brachii caput longum and no accessory humeral head (Owen, 1866; Murie & Mivart, 1872; Beddard, 1891; Primrose, 1899; Sonntag, 1922a; Woollard, 1925; Beattie, 1927; Patterson, 1942; Miller, 1952; Hill, 1959; Schön, 1968; Soligo, 2005; Standring et al., 2005).

Summary: A single head of m. triceps brachii caput longum seems to be primitive for Theria. Presence of two distinct heads of m. triceps brachii caput longum originating from the scapula is a feature shared by *Orycteropus* and afrotheres, Cingulata, as well as some Laurasiatheria. More commonly in Laurasitheria and Euarchontoglires there is an accessory humeral head of origin of m. triceps brachii; possibly the origin of the additional head of m. triceps brachii caput longum has migrated caudally in this case. Further study of the distribution of this feature is needed, as it is easy to miss during dissection.

Sesamoid in tendon of insertion of mm. triceps brachii

The cartilaginous sesamoid I observed in the tendon of insertion of mm. triceps brachii caput longum et laterale in the macroscelidids and *Microgale* is not unlike the patella. Such a sesamoid, the patella cubiti, is a rare anomaly in humans (Sykes, 1963). In many bats, the heads of mm. triceps brachii insert on a rod-like sesamoid that articulates at the elbow (Humphry, 1869a; Vaughan, 1959; Vaughan & Bateman, 1970; Norberg, 1972; Altenbach, 1979). This interesting sesamoid surely occurs in other mammals and should be studied further.

Character 33. M. anconeus

Absent or completely fused with mm. triceps brachii? (0), small, mostly fused with mm. triceps brachii (1), large and distinct (2)

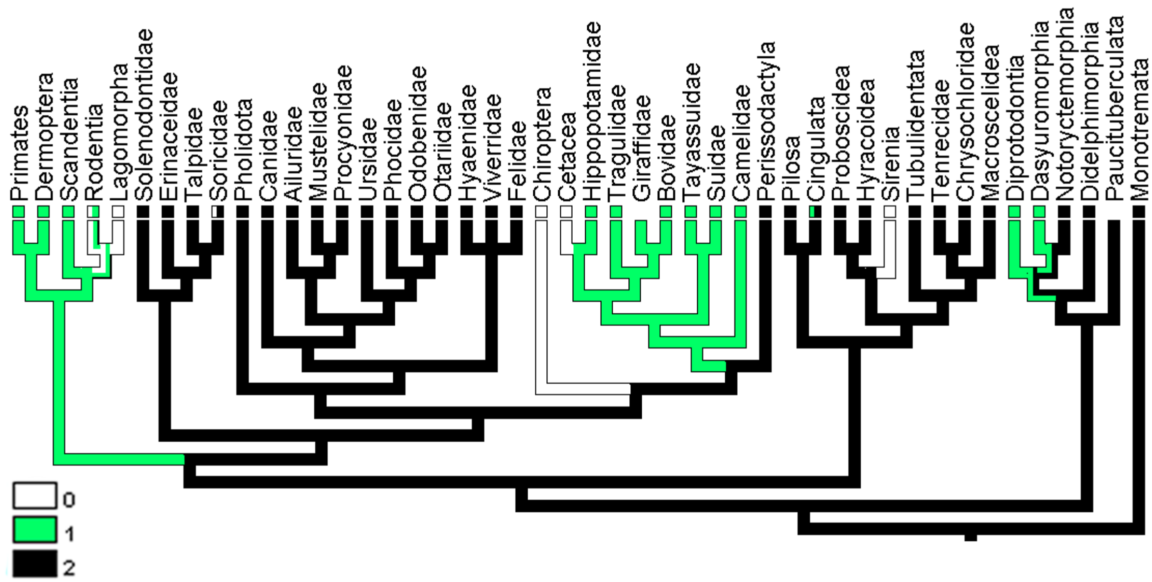

Figure 4.33 Phylogeny depicting character states of m. anconeus.

M. anconeus can be overlooked because it is smaller and deeper than the heads of mm. triceps brachii and may be fully or partially fused with m. triceps brachii caput mediale. The muscle is, however, present in most mammals. It is a large triangle of muscle originating from the caudal surface of the distal humerus in some mammals, and a small slip of muscle from the caudal surface of the lateral epicondyle or olecranon fossa in others. It inserts on the lateral side of the olecranon or may extend distally along the lateral ulna deep to m. extensor digitorum profundus. There is disagreement about whether the muscle is derived from mm. triceps brachii or a muscle found in other tetrapods, the "extensor antebrachii et carpi ulnaris" (Howell, 1937; Diogo et al., 2009; Diogo & Abdala, 2010). I have grouped it with mm. triceps brachii due to its function and radial nerve innervation.

The muscle is large and distinct in *Tachyglossus* (Mivart, 1866; Walter, 1988). In *Ornithorhynchus* it seems to be subdivided into two portions: a large part on the caudal surface of the distal humerus deep to mm. triceps brachii, which inserts on the cranial surface of the olecranon, and a smaller part extending from the lateral epicondyle to the lateral ulna (Coues, 1870).

Within Marsupialia it is present as a distinct muscle, although quite variable in form (Cunningham, 1882). It is very large in *Notoryctes* (Wilson, 1894), and substantial in most other marsupials (Sidebotham, 1885; Parsons, 1896b; Stein, 1981; Macalister, 1870; Hopwood, 1974; Cunningham, 1882; Harvey & Warburton, 2010). It is not mentioned for *Caenolestes* (Osgood, 1921), and is small and can be merged with mm. triceps brachii in many dasyuromorphs (Cunningham, 1882; MacCormick, 1886; Macalister, 1870; Jones, 1949; Stein, 1981).

The muscle was described as absent in *Orycteropus* by Humphry (1868) and was not reported by others (Galton, 1870; Sonntag, 1925; Thewissen & Badoux, 1986); however, it was clearly present in my specimen, extending up the caudal surface of the humerus, despite fusion on its medial edge with m. triceps brachii caput mediale. I observed the same condition in my specimens of Tenrecoidea and Macroscelidea, although Jullien (1967) described the muscle as rudimentary in macroscelidids. In the Hyracoidea and Chrysochloridae, m. anconeus is very robust and covers much more of the caudal surface of the humerus than the muscle does in most mammals (Campbell, 1938; Jullien, 1967). Indeed, a large and distinct m. anconeus is typical in afrotheres except Sirenia, where it is not reported (Murie & Mivart, 1865; Murie, 1872a; Miall & Greenwood, 1878a; Dobson, 1883; Parsons, 1901; Campbell, 1938; Shindo & Mori, 1956a; Verheyen, 1961; Nelsen, 1965; Jullien, 1967; Domning, 1978; Neveu & Gasc, 2002).

Full descriptions of m. anconeus are lacking for most Xenarthra. The muscle is described as “distinct” and “large” in *Bradypus* (Humphry, 1869b; Macalister, 1869a); in other Xenartha it is a distinct muscle which originates from the olecranon fossa and seems to have an extensive insertion on the ulna (Galton, 1869a, 1869b; Humphry, 1869b). It is very small in *Chlamyphorus* (Macalister, 1875a).

Most eulipotyphlans have a large m. anconeus from the caudal surface of the lateral epicondyle (Dobson, 1882b, 1883; Parsons, 1898a; Allen, 1910; Reed, 1951; Sharma, 1958; Jullien, 1967; Whidden, 2000; Neveu & Gasc, 2002). The muscle is rudimentary in *Crocidura* but very well developed in *Talpa* (Jullien, 1967). *Manis* and Carnivora have large m. anconeus (Humphry, 1868, 1869; Mivart, 1872, 1882; Watson & Young, 1879; Allen, 1882; Kelley, 1888; Young & Robinson, 1889; Beddard, 1900; Reighard & Jennings, 1901; Hall, 1926; Howell, 1929; Campbell, 1936; Fisher, 1942; Davis, 1964; Getty, 1975; Leach, 1977; Spoor & Badoux, 1986a; Feeney, 1999; Fisher et al., 2009; Julik et al., 2012).

In Perissodactyla m. anconeus seems to be fleshy and to have a larger origin from the distal humerus, but descriptions of the muscle are scanty (Strangeways et al., 1869; Murie, 1871; Sisson, 1914; Bressou, 1961). M. anconeus is not described in Chiroptera and presumably it is absent (Humphry, 1869a; Vaughan, 1959; Vaughan & Bateman, 1970; Norberg, 1972; Altenbach, 1979; Hermanson & Altenbach, 1983).

The muscle tends to fuse with m. triceps brachii caput mediale in artiodactyls, but as in *Orycteropus*, the remaining muscle fibers originate more proximally along the caudal surface of the humerus (Campbell, 1936; Kneepkins et al., 1989; Budras, 2004; Fisher et al., 2007). The only cetacean with a possible remant of this muscle is *Physeter*; otherwise the muscle is absent in whales (Cooper et al., 2007).

M. anconeus also merges with triceps brachii caput mediale in Scandentia (Le Gros Clark, 1924, 1926; George, 1977). Most rodents have a small m. anconeus often fused with m. triceps brachii caput mediale, but it may be absent (Howell, 1932; McEvoy, 1982; Stein, 1986). I can find no mention of the muscle in Lagomorpha (Bensley, 1921; Crabb, 1931; Craigie, 1966), presumably it has fused completely with m. triceps brachii caput mediale. In man and non-human Primates the muscle is typically distinct but small, with an origin from the caudal surface of the lateral epicondyle (Owen, 1866; Murie & Mivart, 1872; Primrose, 1899; Beattie, 1927; Patterson, 1942; Miller, 1952; Hill, 1959; Schön, 1968; Soligo, 2005; Standring et al., 2005).

Summary: *Orycteropus* and other afrotheres have a large and distinct m. anconeus, as do most mammals. Artiodactyla, Euarchontoglires, and some Marsupialia however, have smaller and less distinct m. anconeus. M. anconeus is quite large in the fossorial mammals *Notoryctes*, *Calcochloris*, *Manis*, and *Talpa*, but seems not as disproportionately big in *Orycteropus*. The greatly enlarged condition of the muscle in Hyracoidea is quite different from the small m. anconeus observed in Artiodactyla.

K. EXTENSOR GROUP – RADIAL NERVE

Character 34. M. brachioradialis

Absent (0), inserts on radius (1), inserts on carpus (2)

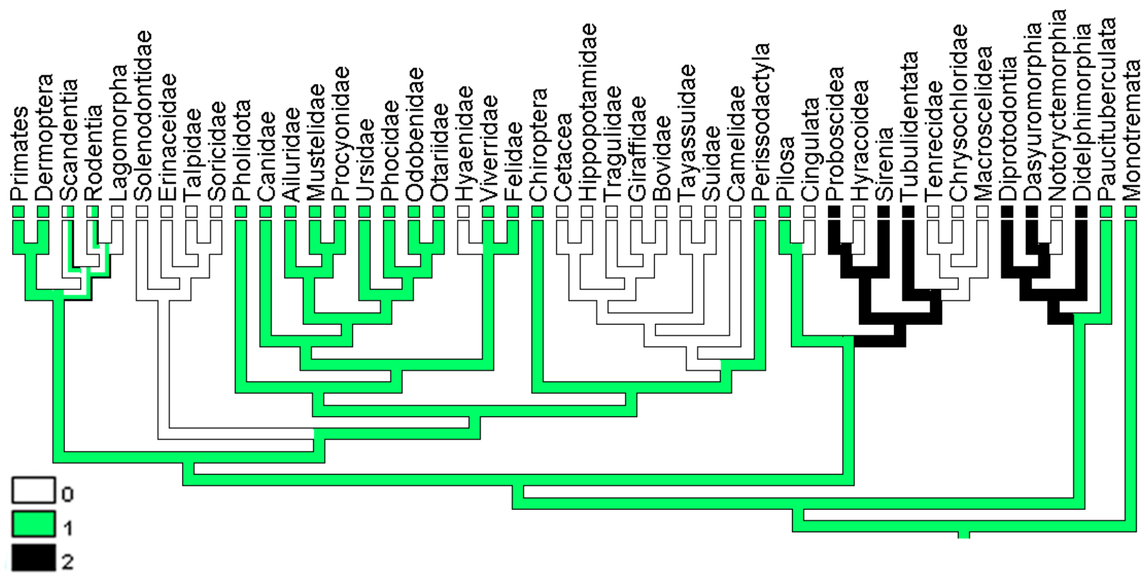

Figure 4.34 Phylogeny depicting character states of m. brachioradialis.

M. brachioradialis is frequently known as m. supinator longus. Of the extensor muscles, it typically originates most proximally from the lateral supracondylar crest of the humerus, and inserts on the carpus or distal radius.

The muscle may not be present in *Ornithorhynchus* (Coues, 1870; McKay, 1895), although it has been described in that genus (Howell, 1936). It is found in the Tachyglossidae and inserts on the radius (Mivart, 1866; Allen, 1912; Walter, 1988). In *Tachyglossus* the muscle may originate from the proximal humerus (Walter, 1988).

M. brachioradialis passes deep to both m. abductor pollicis longus and the annular ligament in marsupials (Cunningham, 1882; MacCormick, 1886). In the Didelphimorphia, Dasyuromorphia, and Diprotodontia, m. brachioradialis inserts on the carpus or occasionally reaches digit I (Macalister, 1870; Coues, 1872; Cunningham, 1882; Young, 1882; Sidebotham, 1885; MacCormick, 1886; Parsons, 1896b; Sonntag, 1922b; Jones, 1949; Hopwood, 1974; Stein, 1981; Harvey & Warburton, 2010; Warburton, 2011). M. brachioradialis inserts on the distal radius in *Caenolestes* (Osgood, 1921). The muscle is absent in *Notoryctes* (Wilson, 1894; Warburton, 2003).

In *Orycteropus*, m. brachioradialis has a very proximal origin from the caudal surface of the neck of the humerus. It inserts on the retinaculum of m. extensor digitorum communis, at the carpus (Sonntag, 1925). In Proboscidea and Sirenia the muscle also inserts on the carpus, with a very proximal origin of the muscle in *Elephas* similar to the condition in *Orycteropus* (Murie, 1872a; Miall & Greenwood, 1878a; Nielsen, 1965; Domning, 1977, 1978). The only other mammal with a description of an origin near the neck of the humerus is *Tachyglossus* (Walter, 1988). The muscle is absent in Afrosoricida, Macroscelidea, and Hyracoidea (Dobson, 1882a, 1883; Parsons, 1901; Windle & Parsons, 1901; Jullien, 1967), unless the slip of muscle named m. cubitalis in this work is a vestigial m. brachioradialis.

M. brachioradialis is also absent in Artiodactyla and Cetacea (Windle & Parsons, 1901; Campbell, 1936; Kneepkins et al., 1989; Fisher et al., 2007).

M. brachioradialis is absent in *Equus*, but found in *Tapirus* and Rhinocerotidae, inserting on the distal radius (Murie, 1871; Beddard & Treves, 1889; Windle & Parsons, 1901; Sisson, 1914; Campbell, 1936; Bressou, 1961). It also inserts on the distal radius in *Manis* and the Carnivora (Devis, 1868; Humphry, 1868, 1869; Murie, 1872d; Allen, 1882; Mivart, 1882; Kelley, 1888; Reighard & Jennings, 1901; Hall, 1926; Howell, 1929; Fisher, 1942; Davis, 1964; Getty, 1975; Leach, 1977; Feeney, 1999; Fisher et al., 2009;

Julik et al., 2012); however, the muscle is absent in Hyaenidae (Watson & Young, 1879; Young & Robinson, 1889; Spoor & Badoux, 1986a).

M. brachioradialis is found in some Chiroptera, inserting on the distal radius (Humphry, 1869a; Vaughan & Bateman, 1970; Norberg, 1972). It inserts on the distal radius in Pilosa and is absent in Cingulata (Galton, 1869a, 1869b; Humphry, 1869b; Macalister, 1869a, 1873). It is also absent in Eulipotyphla (Dobson, 1881a, 1882b, 1883; Parsons, 1898a; Allen, 1910; Reed, 1951; Sharma, 1958; Jullien, 1967; Whidden, 2000).

The muscle inserts on the distal radius in many rodents (Howell, 1932; McEvoy, 1982; Thorington et al., 1997; Bezuidenhout & Evans, 2005). It is also frequently absent in rodents (Parsons, 1898b; Howell, 1932; Greene, 1935; Rinker, 1954; Woods, 1972; Ryan, 1989; Abdala & Diogo, 2010). It is not mentioned in descriptions of rabbit anatomy and is presumably absent (Bensley, 1921; Crabb, 1931; Craigie, 1966).

M. brachioradialis inserts on the distal radius in Tupaiidae but is absent in Ptilocercidae (Le Gros Clark, 1924, 1926; Haines, 1955; George, 1977). In Primates and *Cynocephalus* the muscle inserts on the distal radius (Owen, 1866; Murie & Mivart, 1872; Primrose, 1899; Woollard, 1925; Beattie, 1927; Patterson, 1942; Miller, 1952; Hill, 1959; Schön, 1968; Soligo, 2005; Standring et al., 2005; Diogo & Abdala, 2010).

Summary: M. brachioradialis has a curious distribution in mammals. In Monotremata the muscle is present and has an insertion on the radius. In Marsupialia and the afrotheres in which m. brachioradialis is present, the muscle inserts on the carpus. In all other eutherian mammals, if m. brachioradialis is present it inserts on the radius. M. brachioradialis thus strongly links *Orycteropus* with Proboscidea and Sirenia.

Character 35. Mm. extensor carpi radialis longus et brevis

Absent (0), two separate muscles (1), one origin with two insertions (2), one origin with one insertion (3), two origins with one insertion (4)

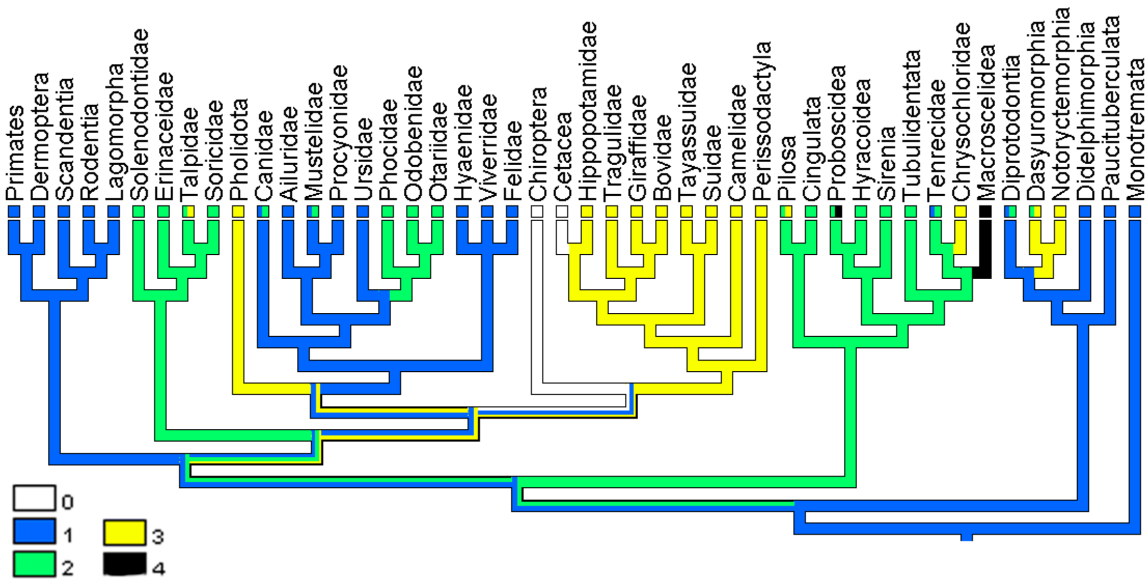

Figure 4.35 Phylogeny depicting character states of mm. extensor carpi radialis.

Mm. extensors carpi radialis longus and brevis typically originate from the lateral supracondylar crest of the humerus, just distal to m. brachioradialis if it is present. Primitively there are two separate muscles; most often the insertion of m. extensor carpi radialis longus is on metacarpal II, and that of m. extensor carpi radialis brevis is on metacarpal III, as in humans. The two portions have fused in a variety of ways in mammals, which is consistent within groups and is the character considered here. There is also some variation in insertion, which may simply be individual variation or error of description and has not been considered as a character here.

In the Monotremata, there are two muscles that are presumably homologous with mm. extensor carpi radialis, although one inserts on the carpus and the other on metacarpal III (Mivart, 1866; Coues, 1870; Allen, 1912; Howell, 1936; Walter, 1988).

In the Didelphimorphia and Paucituberculata, the two muscles have their characteristic conformations and insert on metacarpals II and III (Coues, 1872; Sidebotham, 1885; Osgood, 1921; Stein, 1981; Linkinhoker, 1997). In the fossorial marsupial mole, however, there is a single belly inserting on metacarpal III (Wilson, 1894; Warburton, 2003). The Dasyuromorphia have a single origin with one or two insertions (Macalister, 1870; Cunningham, 1882; MacCormick, 1886; Jones, 1949). The condition of the muscle is mixed in the Diprotodontia, with some genera having a single origin and dual insertions (Macalister, 1870; Hopwood, 1974; Warburton, 2011), and some having two separate muscles (Cunningham, 1882; Young, 1882; Parsons, 1896b; Sonntag, 1922b; Harvey & Warburton, 2010).

There are two separate mm. extensor carpi radialis in *Microgale*, but the muscles are fused at their origin in other tenrecs and have separate insertions on metacarpals II and III (Dobson, 1882a; Verheyen, 1961; Jullien, 1967; Neveu & Gasc, 2002). *Orycteropus* has the same condition as the tenrecs (Galton, 1870; Sonntag, 1925). The hyracoids and *Trichechus* are very similar as well (Murie & Mivart, 1865; Murie, 1872a; Windle & Parsons, 1901; Domning, 1978). In the chrysochlorids, however, there is but a single muscle which inserts on either metacarpal II (Dobson, 1883; Puttick & Jarvis, 1977; Gasc et al., 1986) or metacarpal III as I observed in *Calcochloris* (Parsons, 1901; Jullien, 1967). In the macroscelidids, the two muscles have separate origins, but fuse and the dual insertion covers both metacarpals II and III (Jullien, 1967). This is a rare variation also noted in the best description of *Elephas* (Nielsen, 1965).

In Xenarthra, there is a single origin of the muscle, and typically two inconsistently positioned distal insertions, although metacarpals II and III are probably the most common sites of insertion (Galton, 1869a; Humphry, 1869b; Macalister, 1869a, 1873; Linkinhoker, 1997). In *Cyclopes*, there is one origin and one insertion on metacarpal III (Galton, 1869b; Humphry, 1869b).

In Eulipotyphla m. extensor carpi radialis also has a single origin with two insertions on metacarpals II and III (Dobson, 1881a, 1882b, 1883; Allen, 1910; Reed, 1951; Sharma, 1958; Gugler, 1959; Jullien, 1967; Neveu & Gasc, 2002). In many talpids the muscle retains only the metacarpal III insertion (Jullien, 1967; Whidden, 2000).

There are separate mm. extensor carpi radialis longus and brevis in Chiroptera, although as in xenarthrans the insertions can vary (Humphry, 1869b; Vaughan, 1959; Vaughan & Bateman, 1970; Norberg, 1972; Altenbach, 1979). In most Carnivora, there are also two separate muscles, with consistent insertions on metacarpals II and III (Allen, 1882; Young & Robinson, 1889; Reighard & Jennings, 1901; Fisher, 1942; Davis, 1964; Getty, 1975; Feeney, 1999; Fisher et al., 2009; Julik et al., 2012). In pinnipeds, the muscles insert instead on digits I and II and seem to have a single origin (Humphry, 1868; Murie, 1872d; Howell, 1929).

There is a single origin and a single insertion on metacarpal III in *Manis* and on metacarpal III or the base of the cannon bone in Perissodactyla and Artiodactyla (Humphry, 1869b; Murie, 1871; Beddard & Treves, 1889; Windle & Parsons, 1901; Sisson, 1914; Campbell, 1936; Getty, 1975; Smuts & Bezuidenhout, 1987; Fisher et al., 2007). M. extensor carpi radialis is absent in Cetacea (Cooper et al., 2007).

Most rodents have two separate mm. extensor carpi radialis with typical insertions on metacarpals II and III (Parsons, 1898b; Greene, 1935; Wood & White, 1950; Rinker, 1954; Woods, 1972; McEvoy, 1982; Kesner, 1986; Stein, 1986; Ryan, 1989; Thorington et al., 1997; Bezuidenhout & Evans, 2005). The same is true of Scandentia, Dermoptera, and Primates (Owen, 1866; Murie & Mivart, 1872; Beddard, 1891; Primrose, 1899; Le Gros Clark, 1924; Woollard, 1925; Patterson, 1942; Miller, 1952; Haines, 1955; Hill, 1959; Schön, 1968; George, 1977; Soligo, 2005; Standring et al., 2005; Diogo & Abdala, 2010). The muscles are briefly fused in the rabbit (Bensley, 1921).

Summary: Two separate mm. extensor carpi radialis are primitive for mammals. Changes in the configuration are consistent within clades. *Orycteropus* and most afrotheres have m. extensor carpi radialis with one origin and two insertions. In many fossorial mammals (*Manis*, *Notoryctes*, *Calcochloris*, talpids) the muscle has a single insertion on metacarpal III, so *Orycteropus* differs from these. *Orycteropus* also differs from Artiodactyla.

Character 36. M. extensor digitorum communis[17]
Single tendon per digit (0), multiple tendons per digit (1)

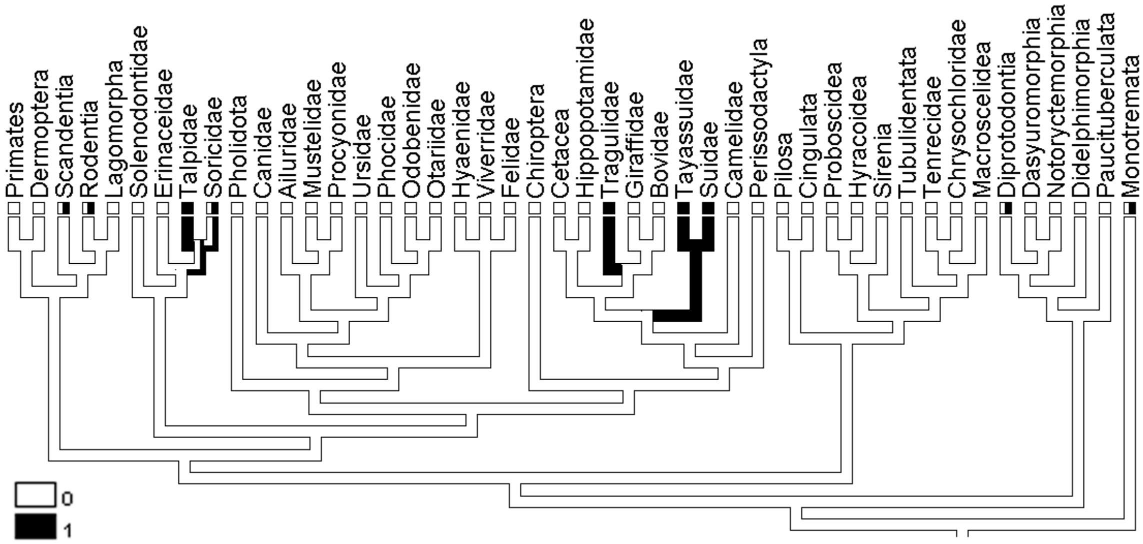

Figure 4.36 Phylogeny depicting character states of m. extensor digitorum communis.

[17] extensor digitorum

M. extensor digitorum communis typically originates from the lateral epicondyle of the humerus and inserts on digits II, III, IV, and V. It can also insert on the pollex, presumably an individual variation as it is rarely observed. Missing insertions on the other digits seem to be merely a function of digit reduction or absence, and therefore are not considered here as a character. Of interest, however, is that the muscle frequently has "many tendons for few toes" (Windle & Parsons, 1901). For example, in the artiodactyl families Tayassuidae, Suidae, and Tragulidae, there are some tendons inserting more proximally on the digits, and other inserting distally. Each digit may receive two or more tendons in this fashion, particularly digits III and IV (Windle & Parsons, 1901; Sisson, 1914; Campbell, 1936).

Additional tendons to digits III or IV have also been observed in *Tachyglossus* (Walter, 1988), Macropodidae (Hopwood, 1974; Warburton, 2011), Soricomorpha (Reed, 1951; Gugler, 1959; Whidden, 2000), Rodentia (Ryan, 1989), and Scandentia (Le Gros Clark, 1924, 1926).

Summary: Neither *Orycteropus* nor any Afrosoricida share this feature of m. extensor digitorum communis with Artiodactyla or Eulipotyphla.

Character 37. M. extensor carpi ulnaris

Absent (0), origin from lateral epicondyle and ulna (1), from lateral epicondyle only (2), from ulna or both radius and ulna (3)

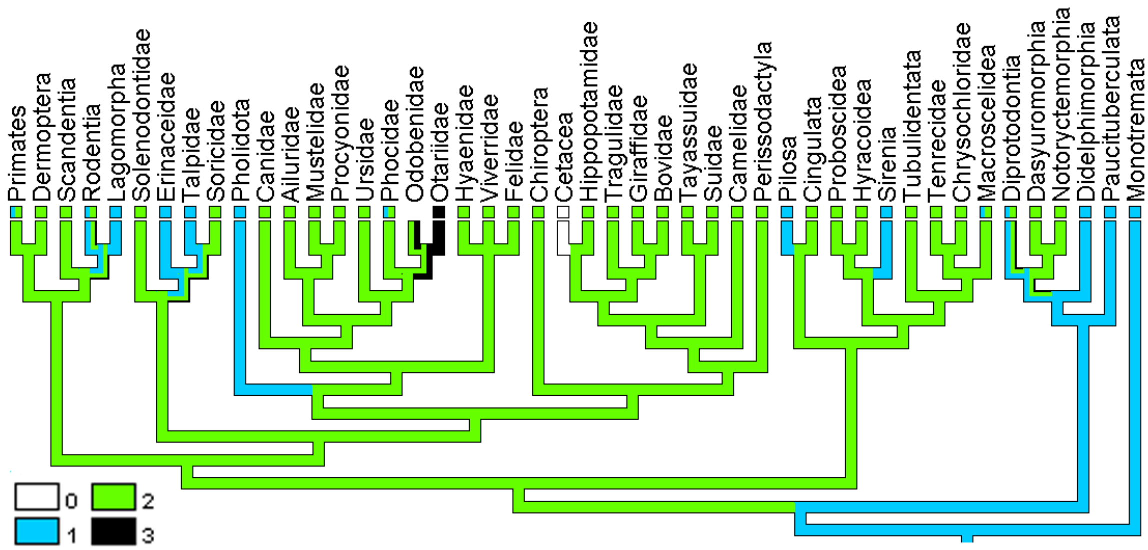

Figure 4.37 Phylogeny depicting character states of m. extensor carpi ulnaris.

M. extensor carpi ulnaris can have two heads of origin or be a single muscle. Typically it inserts on the base of metacarpal V, but sometimes the insertion includes the pisiform or other digits, especially in mammals with digit reduction. Sometimes the muscle is called the "ulnaris lateralis" (Nomina Anatomica Veterinaria, 2005).

In the Tachyglossidae, m. extensor carpi ulnaris originates from both the lateral epicondyle and the ulna, and inserts on digit V (Mivart, 1866; Allen, 1912; Walter, 1988). In Didelphidae and *Caenolestes*, the muscle has both origins and its more typical insertion on metacarpal V (Coues, 1872; Sidebotham, 1885; Osgood, 1921; Stein, 1981; Linkinhoker, 1997). In *Notoryctes*, the ulnar origin is absent (Wilson, 1894; Warburton, 2003). This is also the case in the Dasyuromorphia, where there are sometimes two insertions of the muscle (Macalister, 1870; Cunningham, 1882; MacCormick, 1886; Jones, 1949). Some diprotodonts have both humeral and ulnar origins, for example

Dendrolagus, *Phascolarctos,* and *Vombatus* (Macalister, 1870; Young, 1882; Sonntag, 1922b; Warburton, 2011), but typically only the origin from the lateral epicondyle is present (Cunningham, 1882; Sonntag, 1922b; Hopwood, 1974; Harvey & Warburton, 2010).

Among Macroscelidea, *Rhynchocyon* and *Petrodromus* retain both the humeral and ulnar origins, but *Elephantulus* and *Macroscelides* do not have an ulnar origin (Jullien, 1967). Sirenians have both origins (Domning, 1977, 1978). In *Orycteropus*, Afrosoricida, Hyracoidea, and Proboscidea, m. extensor carpi ulnaris usually originates only from the lateral epicondyle (Galton, 1870; Miall & Greenwood, 1878a; Parsons, 1901; Windle & Parsons, 1901; Sonntag, 1925; Shindo & Mori, 1956a; Verheyen, 1961; Nielsen, 1965; Jullien, 1967; Gasc et al., 1986; Neveu & Gasc, 2002). There are several descriptions indicating that both origins are found in these orders, however, potentially leaving the afrotheres mixed (Murie & Mivart, 1865, for *Procavia*; Humphry, 1868, for *Orycteropus*; Dobson, 1883, for *Tenrec*). A notable feature of *Orycteropus* is the insertion of m. extensor carpi ulnaris on both metacarpals IV and V, a situation seen also in *Cyclopes* (Humphry, 1868, 1869; Galton, 1870; Sonntag, 1925).

The sloths and anteaters have both humeral and ulnar origins (Humphry, 1869b; Galton, 1869b), but the Dasypodidae have only the origin from the lateral epicondyle (Macalister, 1875a; Linkinhoker, 1997).

The Erinaceidae and Talpidae seem typically to have both origins (Dobson, 1881a, 1882b, 1883; Whidden, 2000; Neveu & Gasc, 2002), while the Soricidae and Solenodontidae have only the origin from the lateral epicondyle (Allen, 1910; Reed, 1951; Sharma, 1958; Gugler, 1959; Jullien, 1967; Neveu & Gasc, 2002).

Chiropterans are quite odd, with only an ulnar or a radial and ulnar origin of m. extensor carpi ulnaris (Humphry, 1869a; Vaughan, 1959; Vaughan & Bateman, 1970; Norberg, 1972; Altenbach, 1979).

Both humeral and ulnar origins are present in *Manis* (Humphry, 1869b). In the Perissodactyla, Carnivora except pinnipeds, and Artiodactyla, only the lateral epicondylar origin of m. extensor carpi ulnaris is present (Murie, 1871; Watson & Young, 1879; Allen, 1882; Reighard & Jennings, 1901; Windle & Parsons, 1901; Sisson, 1914; Hall, 1926; Campbell, 1936; Fisher, 1942; Davis, 1964; Getty, 1975; Spoor & Badoux, 1986a; Kneepkins et al., 1989; Feeney, 1999; Fisher et al., 2007, 2009; Julik et al., 2012). The condition in pinnipeds is varied, and sometimes is only from the ulna (Murie, 1872d; Howell, 1929). The muscle is not described and presumably is absent in Cetacea.

Lagomorpha retain both humeral and ulnar origins of m. extensor carpi ulnaris (Bensley, 1921; Craigie, 1966). Typically primates retain both humeral and ulnar origins (Murie & Mivart, 1872; Beddard, 1891; Primrose, 1899; Woollard, 1925; Beattie, 1927; Patterson, 1942; Hill, 1959; Standring et al., 2005), but some have only an origin from the lateral epicondyle (Owen, 1866; Miller, 1952; Schön, 1968; Soligo, 2005). As in primates, the situation in rodents is varied, with some rodents retaining both origins (Howell, 1932; Young, 1937; Rinker, 1954; Woods, 1972; McEvoy, 1982; Stein, 1986), and some with only the origin from the lateral epicondyle (Howell, 1932; Greene, 1935; Wood & White, 1950; Ryan, 1989; Thorington et al., 1997; Bezuidenhout & Evans, 2005). Scandentia and Dermoptera only have a lateral epicondylar origin (Champneys, 1871; Le Gros Clark, 1924, 1926; George, 1977; Endo, 1999).

Summary: Primitively m. extensor carpi ulnaris has both an ulnar and a humeral origin. The ulnar origin is lost in most mammals, including *Orycteropus*. Both origins are retained in most Eulipotyphlans, differing from the Afrosoricida.

Character 38. M. supinator[18]

Absent (0), origin only from lateral epicondyle (1), origin includes elbow joint capsule, radius, or ulna (2)

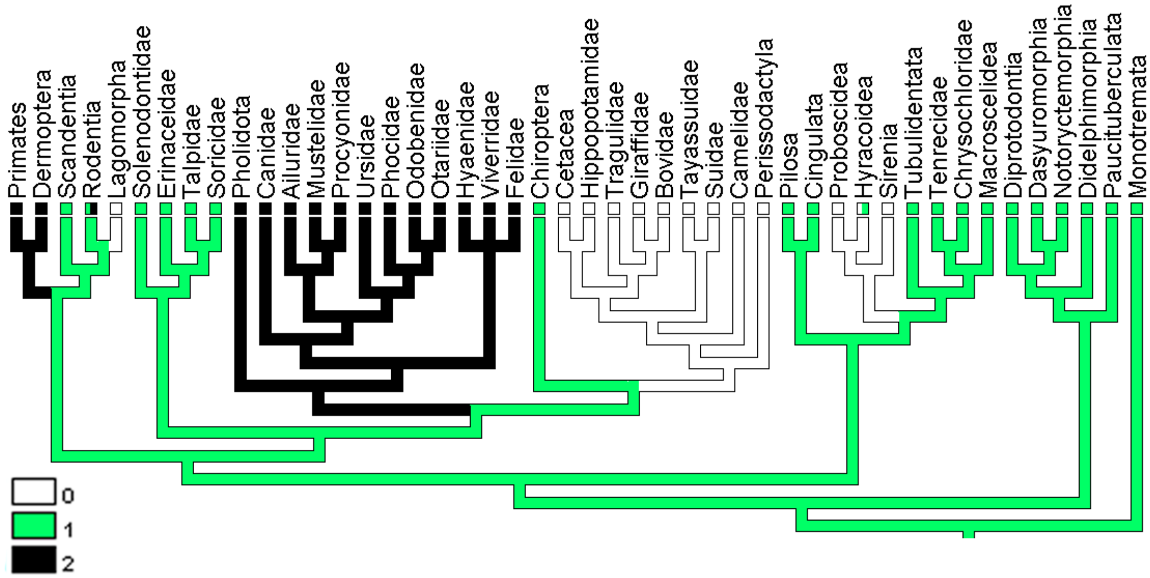

Figure 4.38 Phylogeny depicting character states of m. supinator.

M. supinator originates from the lateral epicondyle of the humerus and sometimes also from the ulna and inserts on the cranial surface of the radius (Jouffroy, 1971).

The muscle originates only from the lateral epicondyle in Monotremata (Mivart, 1866; Coues, 1870; Allen, 1912; Walter, 1988) and Marsupialia (Macalister, 1870; Coues, 1872; Young, 1882; Sidebotham, 1885; MacCormick, 1886; Wilson, 1894; Jones, 1949; Hopwood, 1974; Stein, 1981; Linkinhoker, 1997; Warburton, 2003; Harvey &

[18] extensor antebrachii radialis, supinator brevis, supinator radii brevis

Warburton, 2010; Warburton, 2011). This is also the case in *Orycteropus* (Humphry, 1868; Galton, 1870), Afrosoricida (Dobson, 1882a, 1883; Verheyen, 1961; Puttick & Jarvis, 1977; Neveu & Gasc, 2002), and Macroscelidea (Jullien, 1967).

M. supinator was absent in my specimens of *Heterohyrax* and *Procavia*. Murie & Mivart (1885) do not mention it for *Procavia*, but Windle & Parsons (1901) described m. supinator as fused with m. abductor pollicis longus in this genus. Thus, data for hyracoids are mixed, but the muscle can definitely be absent. M. supinator seems to be absent in the other paenungulates as well, though it is typically not mentioned (Murie, 1872a; Miall & Greenwood, 1878a; Windle & Parsons, 1901; Shindo & Mori, 1956a; Nielsen, 1965; Domning, 1977, 1978).

M. supinator is also absent in the Perissodactyla, Artiodactyla, Cetacea, and Lagomorpha, though again it is typically not mentioned in descriptions (Murie, 1871; Windle & Parsons, 1901; Beddard, 1909; Sisson, 1914; Campbell, 1936; Bressou, 1961; Jouffroy, 1971; Getty, 1975; Kneepkins et al., 1989; Cooper et al., 2007; Fisher et al., 2007). Whether loss of the muscle is related to fusion of the radius and ulna is not clear, as the muscle is present in macroscelidids, in which the forearm bones are fused.

An interesting feature of the muscle seen in rodents, primates, carnivorans, and *Manis* is the slight shift in the origin to include the ligaments of the proximal radius and even part of the ulna. In rodents, the muscle retains its origin from the lateral epicondyle but often extends to include the humeroradial joint capsule or a sesamoid or ligaments of the proximal radius (Parsons, 1898b; Howell, 1932; Rinker, 1954; Woods, 1972; McEvoy, 1982; Kesner, 1986; Ryan, 1989). In primates, in addition to attaching to the lateral epicondyle and/or the annular ligament of the radius, m. supinator may also originate from the ulna (Primrose, 1899; Patterson, 1942; Miller, 1952; Hill, 1959;

Schön, 1968; Soligo, 2005; Standring et al., 2005). It is the same in *Cynocephalus* (Champneys, 1871). In Carnivora the tendency is for an origin from the humeroradial joint capsule or ligaments of the radius only (Murie, 1872d; Watson & Young, 1879; Allen, 1882; Reighard & Jennings, 1901; Hall, 1926; Howell, 1929; Fisher, 1942; Davis, 1964; Getty, 1975; Leach, 1977; Feeney, 1999; Fisher et al., 2009; Julik et al., 2012). In *Manis*, the origin of m. supinator is from a sesamoid that articulates with both the lateral epicondyle and the head of the radius (Humphry, 1869b).

Summary: *Orycteropus*, Afrosoricida, and Macroscelidea share the primitive condition of an origin of m. supinator only from the lateral epicondyle of the humerus. Paenungulata, Artiodactyla, and Perissodactyla are lacking the muscle, although I did observe a vestigial m. supinator in *Procavia*.

Character 39. M. extensor digitorum profundus

Absent (0), single muscle (1), differentiated into two parts, i.e., extensor indicis and extensor pollicis longus (2)

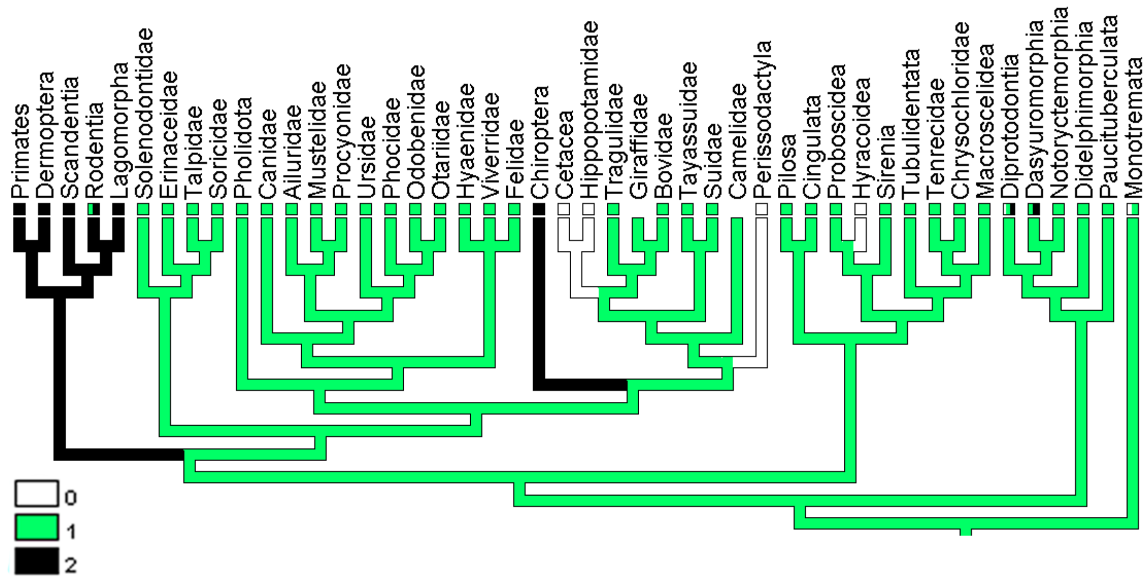

Figure 4.39 Phylogeny depicting character states of m. extensor digitorum profundus.

M. extensor digitorum profundus originates from the ulna and typically inserts on digits I and II, but may insert also on digits III and IV. For this reason, I do not find the terms "extensor digiti I" and "extensor digiti II" employed by the Nomina Anatomica Veterinaria (2005) to be appropriate for many mammals. Similarly inappropriate for general use are the human terms "extensor pollicis longus" and "extensor indicis" (Terminologia Anatomica, 1998). As the muscle lies deep to m. extensor digitorum communis, in fact travelling under the extensor retinaculum deep to m. extensor digitorum communis in many mammals (*Euphractus* - Galton, 1869a; marsupials – Cunningham, 1882; *Heteromys* - Ryan, 1989), I find the commonly employed term m. extensor digitorum profundus to be an apt term. In some mammals, such as *Homo*, the muscle differentiates into portions allowing individual control of the served digits, in which case the terms "extensor pollicis longus" and "extensor indicis" are appropriate.

M. extensor digitorum profundus is absent in Tachyglossidae. Descriptions are ambiguous but the muscle may be present inserting on digits I, II, and III in *Ornithorhynchus* (Mivart, 1866; Coues, 1870; McKay, 1895; Allen, 1912; Howell, 1936; Walter, 1988).

In the Didelphimorphia and *Caenolestes*, the muscle inserts on digits I and II (Coues, 1872; Sidebotham, 1885; Osgood, 1921; Stein, 1981; Linkinhoker, 1997). In *Notoryctes*, due to digit reduction, the muscle serves digits II and III (Wilson, 1894; Warburton, 2003).

In the Dasyuromorphia, the muscle is large and inserts on various combinations of digits I – IV, serving at least three digits (Macalister, 1870; Cunningham, 1882; MacCormick, 1886; Jones, 1949). It seems to be differentiated into two portions in *Dasyurus* and *Sacrophilus*, with a special muscle serving the pollex, (Macalister, 1870; MacCormick, 1886).

This contrasts with the Diprotodontia, in which m. extensor digitorum profundus tends to be reduced. It is typical in Macropodidae and inserts on digits I, II, and III (Parsons, 1896b; Hopwood, 1974). It seems to be differentiated into two reduced portions allowing individual control of digits I and III in *Spilocuscus* (Cunningham, 1882). M. extensor digitorum profundus is absent in *Phascolarctos* and reduced to a single tendon to digit I or absent in *Vombatus* (Macalister, 1870; Young, 1882; Sonntag, 1922b).

Orycteropus, lacking digit I, has m. extensor digitorum profundus inserting on digits II and III (Humphry, 1868; Galton, 1870; Sonntag, 1925). I observed m. extensor digitorum profundus inserting on both digits II and III in *Calcochloris*, but other descriptions of the muscle in chrysochlorids report only an insertion on digit II (Dobson, 1883; Jullien, 1967; Puttick & Jarvis, 1977; Gasc et al., 1986).

Tenrecs and macroscelidids typically have m. extensor digitorum profundus inserting on digits I and II (Dobson, 1882a; Jullien, 1967; Neveu & Gasc, 2002). The muscle may occasionally extend to digit III as well, as I observed in *Elephantulus* and Verheyen (1961) saw in *Micropotamogale*. In *Rhynchocyon*, the muscle inserts only on digit II due to digit reduction (Jullien, 1967).

M. extensor digitorum profundus is absent in Hyracoidea (Murie & Mivart, 1865). It is found in the other paenungulates, however, inserting on both digits I and II or sometimes only on digit II in *Elephas* and just metacarpal I in Sirenia (Murie, 1872a; Miall & Greenwood, 1878a; Windle & Parsons, 1901; Shindo & Mori, 1956a; Nielsen, 1965; Domning, 1977, 1978).

M. extensor digitorum profundus is absent in Perissodactyla, though typically is not mentioned (Murie, 1871; Beddard & Treves, 1889; Windle & Parsons, 1901; Sisson, 1914). In *Tapirus*, Bressou (1961) noted a small slip of muscle from the ulna to the pollex, which could be a vestigial m. extensor digitorum profundus.

In Artiodactyla, the muscle is often not mentioned in descriptions, and may commonly be absent as in *Choeropsis* (Fisher et al., 2007). The muscle is reduced or vestigial and inserts on digits II and/or III, or joins with the tendons of m. extensor digitorum communis (Bell, 1876; Windle & Parsons, 1901; Sisson, 1914; Getty, 1975;

Kneepkins et al., 1989). The muscle is not mentioned in Cetacea, and presumably it is absent like most of the forearm muscles (Cooper et al., 2007).

In Xenarthra, m. extensor digitorum profundus is reduced and inserts only on digit I or digit II (Galton, 1869a; Humphry, 1869b; Macalister, 1869a, 1873; Murie, 1872b; Linkinhoker, 1997).

In Erinaceidae and Talpidae, m. extensor digitorum profundus inserts only on digits I and II (Dobson, 1881a, 1882b, 1883; Parsons, 1898a; Reed, 1951; Jullien, 1967; Whidden, 2000; Neveu & Gasc, 2002). In Soricidae and Solenodontidae, m. extensor digitorum profundus often inserts on digit III as well (Dobson, 1882b; Reed, 1951; Sharma, 1958; Gugler, 1959; Jullien, 1967).

In *Manis*, the muscle is large and inserts on digits I, II, and III (Humphry, 1869b). In most Carnivora, m. extensor digitorum profundus typically inserts on digits I and II, but can also insert on digit III in Felidae, *Canis*, and *Procyon* (Allen, 1882; Reighard & Jennings, 1901; Hall, 1926; Fisher, 1942; Davis, 1964; Getty, 1975; Leach, 1977; Feeney, 1999; Julik et al., 2012). In pinnipeds the muscle is reduced and only inserts on digit I (Humphry, 1868; Murie, 1872d; Howell, 1929).

In Chiroptera, the muscle is differentiated into two portions, with an independent portion serving the pollex and the other part typically serving digit II (Humphry, 1869a; Vaughan, 1959; Vaughan & Bateman, 1970; Norberg, 1972; Altenbach, 1979).

In rodents, m. extensor digitorum profundus typically inserts on digits I and/or II (Parsons, 1898b; Howell, 1932; Young, 1937; Wood & White, 1950; Rinker, 1954; Woods, 1972; McEvoy, 1982; Kesner, 1986; Stein, 1986; Ryan, 1989; Thorington et al., 1997; Bezuidenhout & Evans, 2005). Sometimes the muscle is differentiated into two portions and there is a tendon for digit III as well (Greene, 1935; McEvoy, 1982; Bezuidenhout & Evans, 2005). In Lagomorpha the muscle inserts on digits I and II and can sometimes be separated into two muscles (Crabb, 1931).

In Scandentia there may be a distinct "extensor pollicis longus," in addition to m. extensor digitorum profundus which inserts on digits II and III (Le Gros Clark, 1926; Haines, 1955). This seems to be the case in *Cynocephalus* also (Champneys, 1871).

In Primates, m. extensor digitorum profundus is differentiated into two extensors, typically an "extensor pollicis longus" serving digit I, and m. extensor digitorum profundus serving digits II, III, and sometimes even IV (Owen, 1866; Murie & Mivart, 1872; Dobson, 1881b; Beddard, 1891; Woollard, 1925; Straus, 1941; Patterson, 1942; Schön, 1968; Soligo, 2005). In the Cebidae, "extensor pollicis longus" is not differentiated (Beattie, 1927; Hill, 1959). M. abductor pollicis longus can also be differentiated into two parts in the Hominidae, the main muscle and a smaller "extensor pollicis brevis" providing a second independent tendon to the pollex (Primrose, 1899; Standring et al., 2005; Diogo & Abdala, 2010). The "extensor pollicis brevis" is absent in almost all other mammals (Hill, 1972).

Summary: *Orycteropus* is like most mammals in having a single m. extensor digitorum profundus which is not differentiated into a special muscle for the pollex.

Character 40. Mm. extensor digitorum breves manus

Absent (0), present (1)

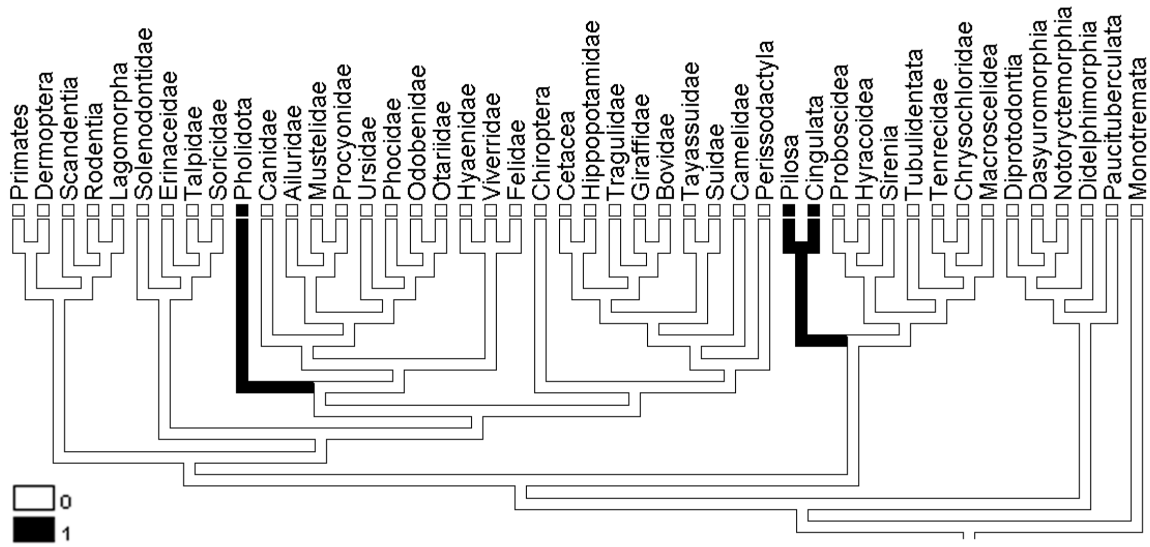

Figure 4.40 Phylogeny depicting character states of mm. extensor digitorum breves manus.

Mm. extensor digitorum breves manus is a group of small muscles that originate on the dorsum of the hand and generally insert on digits II and III, or join the tendons of m. extensor digitorum communis. The muscles are found in Xenarthra and *Manis* (Galton, 1869b; Humphry, 1869b; Macalister, 1869a, 1875; Jouffroy, 1971).

L. FLEXOR GROUP – MEDIAN and ULNAR NERVES

"The ulnaris and radialis muscles of the Mammalia are usually rather uniform in their locations, but the digitorum muscles – especially the flexors – are annoyingly in the habit of occurring in a great number of combinations." (Howell, 1929: 76)

Character 41. M. pronator teres[19]
Absent or tendinous (0), typical (1), enlarged (2)

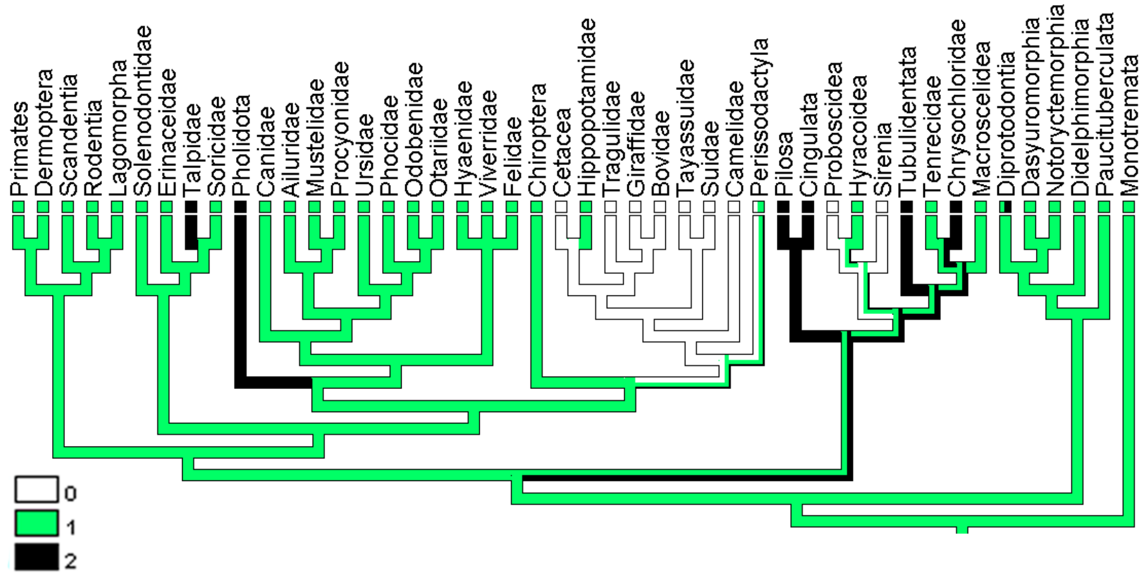

Figure 4.41 Phylogeny depicting character states of m. pronator teres.

M. pronator teres originates on the medial epicondyle and typically inserts on the middle of the radius (Macalister, 1869b; Jouffroy, 1971). In mammals m. pronator teres always lies superficial to the median nerve, which innervates the muscle (Macalister, 1869b; Straus, 1942), although radial nerve innervation is reported in bats (Vaughan, 1959). In most mammals the muscle varies only in the extent of its radial attachment.

M. pronator teres is huge in the fossorial *Scapanus* (Reed, 1951) and extends to the distal radius in *Vombatus* and *Notoryctes* (Macalister, 1870; Wilson, 1894; Sonntag,

[19] flexor antibrachii medialis, pronator radii teres, rond pronateur

1922b; Warburton, 2003), *Orycteropus* (Galton, 1870; Sonntag, 1925), *Calcochloris*, Xenarthra (Galton, 1869a, 1869b; Humphry, 1869b; Macalister, 1869a, 1875; Murie, 1872b; Windle & Parsons, 1899a), and *Manis* (Humphry, 1869b). This appears to be a feature shared by fossorial animals, regardless of actual ability to pronate and supinate, because the "muscle is a powerful flexor and in most mammals movements of pronation and supination are inextricably linked to the flexion and extension of the forearm" (Jouffroy, 1971).

This is not the case in some catarrhine primates, including humans, which have an additional origin of the muscle from the coronoid process of the ulna (Primrose, 1899; Patterson, 1942; Miller, 1952; Standring et al., 2005). This allows these primates to pronate and supinate the bones of the forearm independent of flexion or extension (Jouffroy, 1971). An aberrant ulnar origin has been reported in a variety of other mammals as well (Straus, 1942).

M. pronator teres can be absent or rudimentary as well. Windle & Parsons (1901) described the muscle as rudimentary in *Procavia*, but I found a fairly typical muscle extending more distally than usual in both *Heterohyrax* and *Procavia*. The muscle is described as a "ligamentous" structure from the medial epicondyle in *Elephas* (Miall & Greenwood, 1878a; Shindo & Mori, 1956a; Nielsen, 1965). M. pronator teres may be absent in *Trichechus* (Domning, 1978).

In Perissodactyla, m. pronator teres seems to be absent in the Rhinocerotidae and absent or reduced in Equidae (Beddard & Treves, 1889; Windle & Parsons, 1901; Sisson, 1914). Information for *Tapirus* is contradictory; Campbell (1936) described a normal condition and Bressou (1961) called the muscle “bien développé,” while others called the muscle “scant” or “feeble” (Murie, 1871; Windle & Parsons, 1901).

In Artiodactyla, m. pronator teres is usually small and tendinous or absent (Windle & Parsons, 1901; Sisson, 1914; Straus, 1942). The tendinous fibers can reach the distal radius, however (Beddard, 1909; Campbell, 1936; Kneepkins et al., 1989; Fisher et al., 2007). The muscle is absent in Cetacea (Macalister, 1869b).

Summary: *Orycteropus*, like other fossorial mammals, has a large m. pronator teres. The muscle is reduced or absent in Artiodactyla, most Perissodactyla, and Paenungualta.

Character 42. M. palmaris longus[20]

Absent (0), origin includes flexors or olecranon in addition to medial epicondyle (1), origin from medial epicondyle (2)

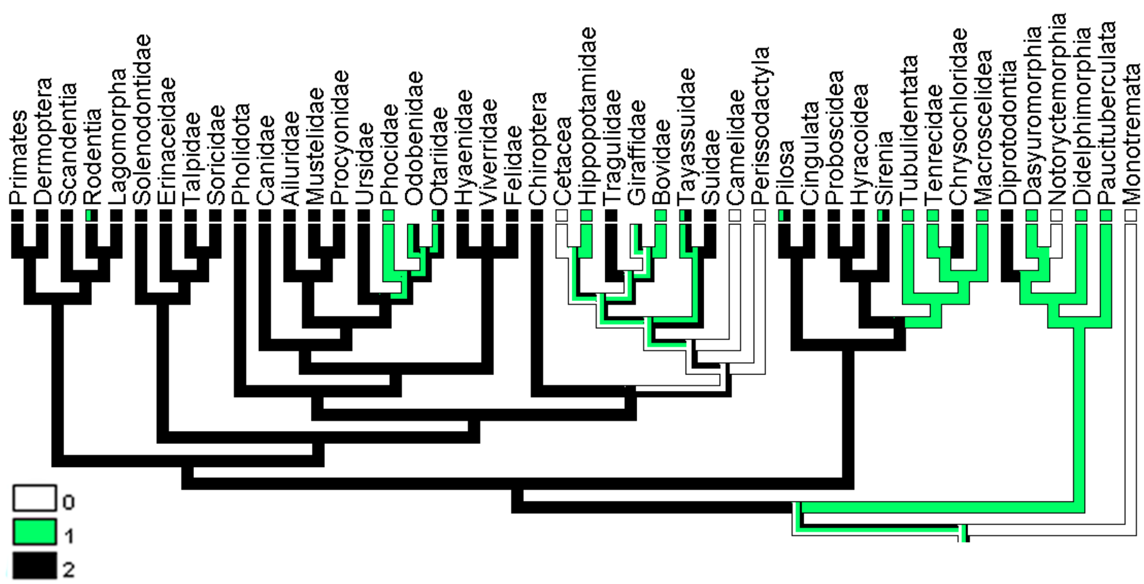

Figure 4.42 Phylogeny depicting character states of m. palmaris longus.

[20] long palmaire, palmaris longus externus

M. palmaris longus can be quite variable, and consequently has suffered from misidentification in anatomical descriptions. Too often innervation is not recorded or is impossible to determine, which hampers interpretation of this muscle. Of some help is the fact that m. palmaris longus develops from subcutaneous mesenchyme and is the only tendon that travels superficial to the flexor retinaculum (Straus, 1942; Spoor & Badoux, 1986b). This is significant when identifying the muscle in mammals in which it is atypical, such as artiodactyls and carnivorans.

It has been suggested that m. palmaris longus develops from either the radial or ulnar divisions of the forearm flexors, or from both (Howell, 1936; Straus, 1942). Thus, m. palmaris longus has been described as having at least two parts: one part originating from the medial epicondyle between mm. flexor carpi radialis and flexor digitorum superficialis, which is called "palmaris longus externus" and is innervated by the median nerve, and one part originating from the medial epicondyle more connected with m. flexor carpi ulnaris, which is called "palmaris longus internus" and is innervated by the ulnar nerve (Jouffroy, 1971).

Whether this is actually the case is debatable given current evidence (Diogo & Abdala, 2010), though the innervation does vary (median and/or ulnar nerves) and some mammals reportedly do have a two-part m. palmaris longus (Windle & Parsons, 1897). A double, or at least "laminated," m. palmaris longus has been described as frequently occurring in marsupials (Straus, 1942). However, the only description I found in which that is the case is for *Caenolestes.* The superficial part of m. palmaris longus inserts on the flexor retinaculum and palmar fascia, while the deep part of m. palmaris longus travels deep to the flexor retinaculum to send slips to digits II-IV (Osgood, 1921). This is perplexing, as the muscle should not travel deep to the flexor retinaculum, but the description is otherwise very good and there are no other descriptions available. In *Scapanus* the muscle has two tendons of insertion and is innervated by both median and ulnar nerves (Reed, 1951). Some carnivorans also supposedly have two parts of m. palmaris longus (Windle & Parsons, 1897; Straus, 1942). Two distinct parts of m. palmaris longus are described for *Lutra* (Fisher, 1942) and for *Procyon* (Allen, 1882). In mustelids, m. palmaris longus has been described as traveling deep to the flexor retinaculum to send tendons to digits II-IV, similar to the situation described for *Caenolestes* (Hall, 1926). It is possible that a single m. palmaris longus has simply split in these cases, rather than there being two muscles that are derived from separate sources (Haines, 1950). Setting aside thoughts about derivation of the muscle, general patterns of proximal attachment of m. palmaris longus are discernable, despite questions about muscle identifications in the literature which I have tried to address. More detailed study of the various distal attachments of m. palmaris longus and innervation of the muscle in more species would be beneficial.

In Monotremata, the muscle is described as absent or fused with m. flexor digitorum profundus (Mivart, 1866; Coues, 1870; Allen, 1912; Diogo & Abdala, 2010). This is also the case in the marsupial mole *Notoryctes* (Wilson, 1894; Warburton, 2003). In other marsupials, m. palmaris longus originates from the medial epicondyle or from between mm. flexor carpi ulnaris and flexor digitorum profundus (Macalister, 1870; Coues, 1872; Sidebotham, 1885; MacCormick, 1886; Sonntag, 1922b; Jones, 1949; Hopwood, 1974; Stein, 1981; Linkinhoker, 1997; Harvey & Warburton, 2010; Warburton, 2011). It typically ends as the palmar fascia, but in the Dasyuromorphia it can have more distinct insertions on digits II-V (Cunningham, 1882; MacCormick, 1886; Jones, 1949).

In many afrotheres, m. palmaris longus originates partially from one or two of the other flexores (Verheyen, 1961; Jullien, 1967; Domning, 1978; my observations). I observed striking similarity in conformation between m. palmaris longus of *Orycteropus* and *Potamogale*. In *Orycteropus* and tenrecs, m. palmaris longus is very large and originates from the medial epicondyle with m. flexor digitorum profundus (Humphry, 1868; Galton, 1870; Dobson, 1882a, 1883; Sonntag, 1925; Verheyen, 1961; Jullien, 1967; Neveu & Gasc, 2002). M. palmaris longus is described as "sometimes absent" in *Chrysospalax* (Parsons, 1901), but I observed a robust muscle innervated by the ulnar nerve and ending at the flexor retinaculum in *Calcochloris*, as did Gasc et al. (1986) in *Eremitalpa*. In other descriptions of chrysochlorid forelimb anatomy I suspect that m. flexor digitorum superficialis has been confused with mm. palmaris longus and flexor digitorum breves manus, thus the muscle has been scored as present in the Chrysochloridae based on my observations. M. palmaris longus also ends at the flexor retinaculum in Macroscelidea according to my observations, but it has been described as reaching the metacarpals (Jullien, 1967). The muscle originates from the flexors and from the medial epicondyle in Macroscelidea. In the Hyracoidea, the muscle is large and ends at the palmar aponeurosis (Murie & Mivart, 1865). It is innervated by the ulnar nerve (Windle & Parsons, 1901). M. palmaris longus originates from the medial epicondyle in Proboscidea and with the flexores in at least one description of Sirenia (Murie, 1872a; Miall & Greenwood, 1878a; Windle & Parsons, 1901; Shindo & Mori, 1956a; Nielsen, 1965; Domning, 1977, 1978).

M. palmaris longus always originates from the medial epicondyle in xenarthrans (Macalister, 1869a, 1873; Murie, 1872b), except in *Cyclopes* in which it originates with m. flexor carpi ulnaris from the olecranon (Galton, 1869b; Humphry, 1869b).

Within Eulipotyphla, m. palmaris longus originates from the medial epicondyle, and very occasionally has a connection with m. flexor digitorum superficialis and/or m. flexor carpi ulnaris (Dobson, 1881a, 1882b, 1883; Reed, 1951; Sharma, 1958; Gugler, 1959; Jullien, 1967; Whidden, 2000; Neveu & Gasc, 2002).

I do not believe that mm. flexor digitorum superficialis and palmaris longus have been identified correctly in artiodactyls, even in modern textbooks of veterinary anatomy such as Konig et al. (2010). Spoor & Badoux (1986b) also raised this issue in their discussion of a similar situation in carnivores (see below). Windle & Parsons (1901) claimed m. palmaris longus is not present in artiodactyls but described m. flexor digitorum superficialis as comprised of "two distinct slips." Since then, it has been stated that the only artiodactyls with m. palmaris longus are hippos (Kajava, 1923; Fisher et al., 2007). In Hippopotamidae, m. palmaris longus originates between mm. flexor digitorum superficialis and flexor carpi ulnaris, and ends by fusing with m. flexor digitorum brevis manus, which forms the perforated tendons for digits IV and V. It is innervated by the median nerve (Campbell, 1936). *Sus* is described as having two bellies of origin of m. flexor digitorum superficialis (Sisson, 1914; Campbell, 1936), one of which corresponds with the location of m. palmaris longus in Hippopotamidae.

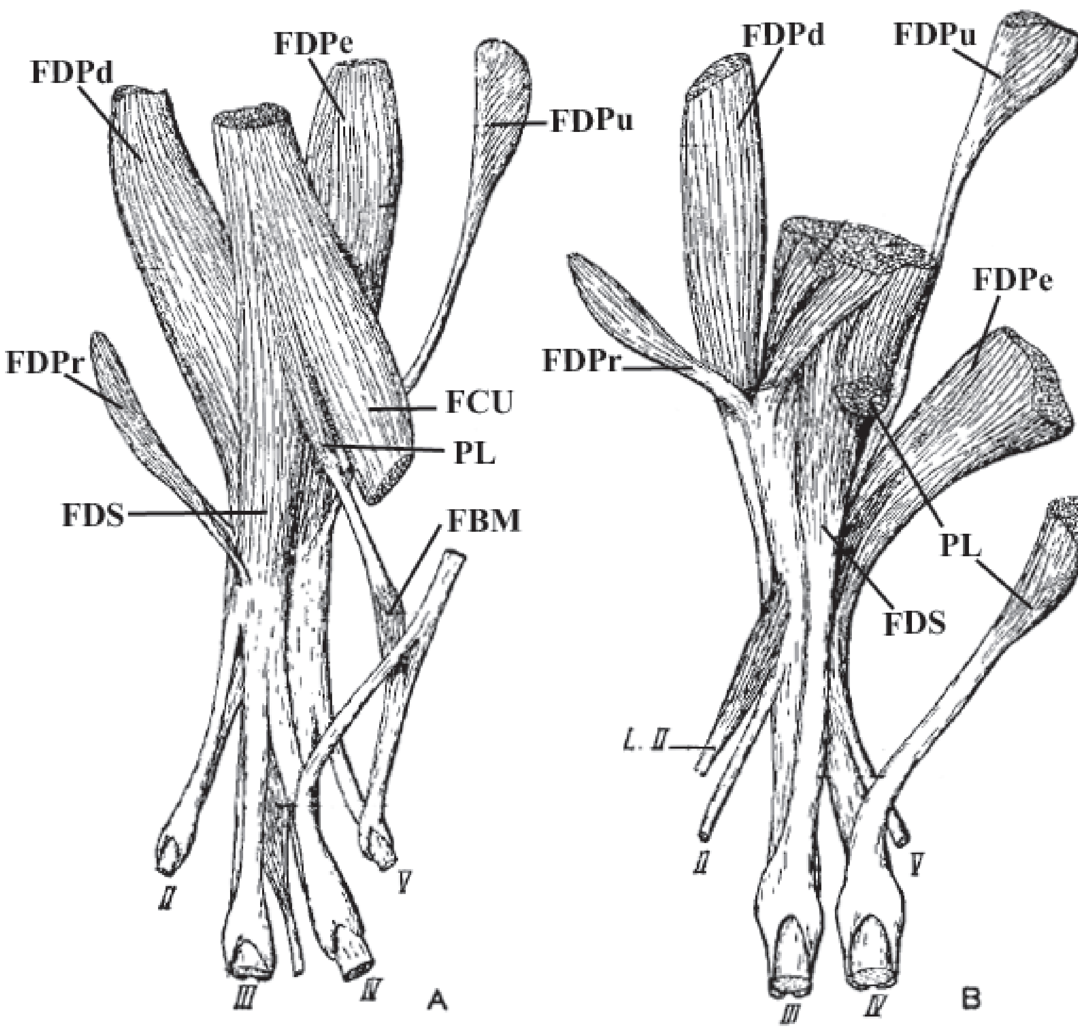

Figure 4.42b. M. palmaris longus in A. *Choeropsis* and B. *Sus* (modified from Campbell, 1936: fig. 6).

It seems likely that in artiodactyls other than hippos, m. palmaris longus has completely merged with m. flexor digiti brevis manus, resulting in a single distal tendon forming a perforated tendon for digit IV. In both my *Pecari* and *Tragulus* specimens, the muscle I have identified as m. palmaris longus does not pass deep to the flexor retinaculum but does form a perforated tendon for digit IV. This is also the case in the description of *Bos* (Sisson, 1914; Getty, 1975), and in *Sus* and ruminants according to Konig et al. (2009:208): “the tendon of the smaller superficial head crosses the flexor retinaculum superficially and forms a tube around the deep digital flexor tendon at the metacarpophalangeal joint. The tendon of the stronger deep head passes distally bound by the flexor retinaculum and ends on the medial phalanx of the third digit after being perforated by the deep digital flexor tendon." M. flexor digitorum superficialis in which half passes superficial to the flexor retinaculum and half passes deep to the flexor retinaculum is highly unusual, as is m. palmaris forming a perforated tendon. It may be that m. palmaris longus is the source of the superficial muscle belly, and the otherwise absent m. flexor digitorum brevis manus is very likely the source of the perforated tendon. I have scored this character in artiodactyls according to this interpretation, depicted in Figure 4.42b. It is unclear if m. palmaris longus is present in Cetacea, but I would assume it is absent as are most forearm muscles (Carte & Macalister, 2007).

A similar situation is seen in *Canis*, with the muscle called "flexor digitorum superficialis" passing "superficial to the flexor retinaculum medial to the accessory carpal bone" (Getty, 1975). This muscle is innervated by the median nerve (Budras, 2007). According to Spoor & Badoux (1986b: 471), "In the 19th century, veterinary anatomists named the M. palmaris longus in the dog M. flexor digitorum superficialis on the basis of a morphological characteristic, i.e., its perforated terminal tendons." As in artiodactyls, this muscle may represent m. palmaris longus fused with m. flexor digitorum brevis manus to form perforated tendons for the digits. The true m. flexor digitorum superficialis in Canidae is the tiny muscle known as "interflexorius," which originates on the palmar surface of the conjoined tendon of m. flexor digitorum profundus and inserts with m. palmaris longus on digits II-IV. Despite this confusion in Canidae, m. palmaris longus originating from the medial epicondyle is recognized throughout Carnivora

(Devis, 1868; Watson & Young, 1879; Allen, 1882; Mivart, 1882; Young & Robsinson, 1889; Reighard & Jennings, 1901; Hall, 1926; Fisher, 1942; Davis, 1964; Getty, 1975; Fisher et al., 2009; Julik et al., 2012). In pinnipeds, m. palmaris longus can originate from the medial side of the olecranon instead of the medial epicondyle (Humphry, 1868; Howell, 1929).

In Chiroptera, there is a single superficial flexor from the medial epicondyle identified as m. palmaris longus rather than m. flexor digitorum superficialis (Vaughan, 1959; Vaughan & Bateman, 1970; Norberg, 1972; Altenbach, 1979). M. palmaris longus seems to be present and connected with m. flexor digitorum superficialis in *Manis* (Humphry, 1869b), but is absent in Perissodactyla (Windle & Parsons, 1901).

Primates supposedly are the only mammals to have the "externus" portion of m. palmaris longus, and the muscle is innervated by the median nerve (Straus, 1942). The muscle originates from the medial epicondyle in Primates, Dermoptera, and Scandentia (Owen, 1866; Champneys, 1871; Murie & Mivart, 1872; Beddard, 1891; Le Gros Clark, 1924, 1926; Woolard, 1925; Beattie, 1927; Patterson, 1942; Straus, 1942; Miller, 1952; Haines, 1955; Hill, 1959; Schön, 1968; George, 1977; Soligo, 2005; Standring et al., 2005). In rodents, the muscle receives ulnar innervation (Woods, 1972) and typically originates from the medial epicondyle (Howell, 1932; Greene, 1935; Rinker, 1954; Woods, 1972; McEvoy, 1982; Kesner, 1986; Stein, 1986; Ryan, 1989; Bezuidenhout & Evans, 2005), but can also take origin from m. flexor digitorum superficialis or olecranon (Parsons, 1898b; Young, 1937; Thorington et al., 1997). M. palmaris longus is small and originates from the medial epicondyle in Lagomorpha (Bensley, 1921; Craigie, 1966).

Summary: M. palmaris longus originates partially from the other flexor musculature in *Orycteropus*, Tenrecidae, Macroscelidea, Marsupialia, and a few artiodactyls and pinnipeds. The muscle is not differentiated in Monotremata, and possibly the differing origins in therian mammals reflect the evolution of this muscle.

Character 43. M. flexor digitorum superficialis[21]

Absent (0), origin from or includes m. flexor digitorum profundus (1), origin from medial epicondyle (2)

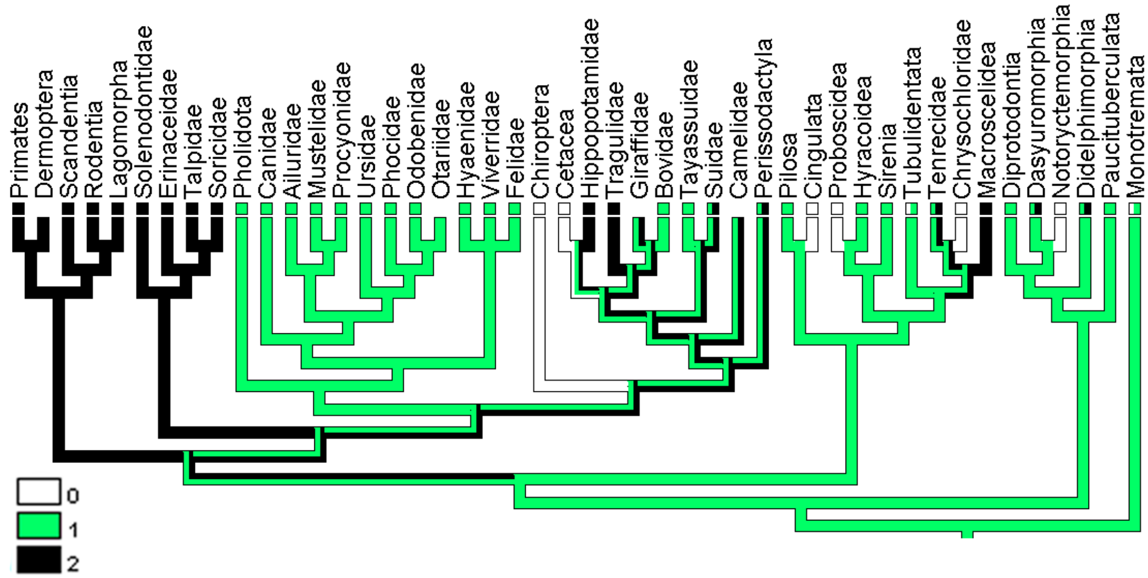

Figure 4.43. Phylogeny depicting character states of m. flexor digitorum superficialis.

M. flexor digitorum superficialis may be a mammalian innovation, and though it is somewhat confused in the literature, it is an excellent muscle to examine for clues about phylogeny (McMurrich, 1903a). The origin of m. flexor digitorum superficialis is primitively associated with one of the three heads of m. flexor digitorum profundus

[21] fléchisseur superficiel des doigts, fléchisseur superficiel des phalanges, flexor digitorum sublimis, flexor perforatus, flexor sublimis

originating from the humerus, typically the "condylo-ulnaris" or most superficial head (Windle, 1889; Windle & Parsons, 1897; McMurrich, 1903b; Haines, 1950). In more derived mammals, the muscle is more substantial and has a bony origin from the medial epicondyle, in which case typically one of the humeral heads of m. flexor digitorum profundus is small or absent (Straus, 1942).

As in reptiles, m. flexor digitorum superficialis is not differentiated in *Tachyglossus* (Mivart, 1866; Allen, 1912; Straus, 1942; Walter, 1988). In *Ornithorhynchus*, a small muscle originates from the tendon of m. flexor digitorum profundus which sends delicate tendons to the digits (Coues, 1870; Howell, 1936).

In marsupials, m. flexor digitorum superficialis is fairly weak, in contrast to the strongly developed m. palmaris longus (Straus, 1942). Reports of the origin of the muscle reveal variation, even within the same genus. The muscle may sometimes originate from the medial epicondyle (Macalister, 1870; Coues, 1872; Jones, 1949; Stein, 1981; Linkinhoker, 1997), or from the "condylo-ulnaris" head of m. flexor digitorum profundus (Cunningham, 1882; Windle, 1889). Regardless, the frailty of the muscle is emphasized: the tendons of m. flexor digitorum superficialis in marsupials are "slender and delicate, like silken threads, somewhat liable to be overlooked or destroyed, unless carefully sought for" (Coues, 1872: 120). Typically, there is a "distinct longitudinal groove" in the tendon of m. flexor digitorum profundus in which are nestled the small bellies and thread-like tendons of m. flexor digitorum superficialis (Cunningham, 1882). M. flexor digitorum superficialis provides perforated tendons for digits II-IV, or has four tendons of insertion in the marsupials that lack m. flexor digitorum brevis manus (Young, 1882). This contrasts with the interpretation that the muscle primitively inserts on the four lateral digits (Woods, 1972).

M. flexor digitorum superficialis is absent in the marsupial mole *Notoryctes* (Wilson, 1894; Warburton, 2003). It also seems to be absent in *Orycteropus*, except in Galton's (1870) specimen, in which a tiny muscle from the surface of m. flexor digitorum profundus served digit III. This is identical to m. flexor digitorum superficialis in my specimen of *Potamogale*, although other tenrecs have a more typical muscle originating from the medial epicondyle and forming perforated tendons for digits II-IV (Dobson, 1882a; Verheyen, 1961; Neveu & Gasc, 2002). It is also similar to the possible m. flexor digitorum superficialis observed in some chrysochlorids extending from the medial epicondyle to digit II (Dobson, 1883; Jullien, 1967; Puttick & Jarvis, 2002), although based on my dissection of *Calcochloris* I believe this muscle may actually be combined mm. palmaris longus and flexor digitorum brevis manus. Further study of this muscle in the chrysochlorids is needed to reliably score this character, but I scored it as absent according to my own observations of *Calcochloris*.

M. flexor digitorum superficialis is typical in Macroscelidea, arising with m. flexor digitorum profundus from the medial epicondyle and forming perforated tendons for digits II-IV (Jullien, 1967). The muscle is quite small in Hyracoidea and Sirenia, originating with m. flexor digitorum profundus from the medial epicondyle and forming perforated tendons for digits II-IV (Murie & Mivart, 1865; Windle & Parsons, 1901). M. flexor digitorum superficialis is absent in Proboscidea (Windle & Parsons, 1901; Shindo & Mori, 1956a; Nielsen, 1965).

Within Xenarthra, the muscle is also reduced. In the Pilosa, it originates from or with m. flexor digitorum profundus and inserts only on digits II-III (Galton, 1869b; Humphry, 1869b). In the Cingulata, the muscle often identified as m. flexor digitorum superficialis originates from the medial epicondyle and inserts on the sesamoid in the tendon of m. flexor digitorum profundus, suggesting that this could be a head of m. flexor digitorum profundus (Galton, 1869a; Murie, 1872b; Macalister, 1875a; Linkinhoker, 1997); therefore, m. flexor digitorum superficialis has been scored as absent.

M. flexor digitorum superficialis is typical in the Eulipotyphla, with an origin from the medial epicondyle, often by three heads, and the muscle forms perforated tendons for digits II-IV (Dobson, 1881a, 1882b, 1883; Parsons, 1898a; Allen, 1910; Haines, 1950; Reed, 1951; Sharma, 1958; Gugler, 1959; Jullien, 1967; Whidden, 2000; Neveu & Gasc, 2002).

In feliforms, m. flexor digitorum superficialis is a small muscle originating from the surface of the "condylo-ulnaris" head of m. flexor digitorum profundus at about midshaft (Devis, 1868; Watson & Young, 1879; Mivart, 1882; Windle, 1889; Reighard & Jennings, 1901; Haines, 1950; Getty, 1975; Spoor & Badoux, 1986a; Julik et al., 2012). Although commonly called "interflexorius" in the Canidae, m. flexor digitorum superficialis has the same attachments in caniforms as the muscle in feliforms (Allen, 1882; Hall, 1926; Davis, 1964; Getty, 1975; Leach, 1977; Feeney, 1999; Fisher et al., 2009). In pinnipeds, the muscle originates from m. flexor digitorum profundus (Humphry, 1868; Murie, 1872d). In *Manis*, the muscle originates from both m. flexor digitorum profundus and from the medial epicondyle (Humphry, 1869b).

M. flexor digitorum superficialis originates from the medial epicondyle in Rhinocerotidae and Equidae, although it is reduced to insert on only digit III in the latter family (Beddard & Treves, 1889; Windle & Parsons, 1901; Sisson, 1914). In Tapiridae, however, the muscle originates from m. flexor digitorum profundus and has both median and ulnar nerve innervation (Campbell, 1936; Bressou, 1961).

M. flexor digitorum superficialis is absent in Chiroptera (Vaughan, 1959; Vaughan & Bateman, 1970; Norberg, 1972; Altenbach, 1979).

Within Artiodactyla, the situation is confused, owing to what I believe is the misidentification of m. palmaris longus, as discussed above. M. flexor digitorum superficialis is generally considered to have two heads, a superficial one from the medial epicondyle and a deeper one often originating from the surface of flexor digitorum profundus. Only one of the heads passed deep to the flexor retinaculum in my specimens of *Pecari* and *Tragulus*, so I interpret this head as m. flexor digitorum superficialis and the head that passes superficial to the flexor retinaculum as m. palmaris longus. In hippopotamids, an individual m. palmaris longus is identified and m. flexor digitorum superficialis originates from the medial epicondyle (Campbell, 1936; Fisher et al., 2007).

In *Oryctolagus*, m. flexor digitorum superficialis is large and strong with a fleshy origin from the medial epicondyle. It is innervated by both the ulnar nerve and the median nerve (Haines, 1950). Innervation is often ulnar in rodents as well (Parsons, 1898b; Woods, 1972), with an origin from the medial epicondyle, and the muscle forms perforated tendons for digits II-IV and often digit V (Parsons, 1898b; Howell, 1932; Greene, 1935; Young, 1937; Wood & White, 1950; Rinker, 1954; Woods, 1972;

McEvoy, 1982; Stein, 1986; Ryan, 1989; Thorington et al., 1997; Bezuidenhout & Evans, 2005).

M. flexor digitorum superficialis has an origin from the medial epicondyle in Scandentia, and it is innervated by the ulnar nerve (Le Gros Clark, 1924, 1926; Straus, 1942; George, 1977; Endo, 1999). Haines (1950), however, described an origin from m. flexor digitorum profundus, but I used the majority opinion to score the character. Within Primates, m. flexor digitorum superficialis has become even more important, with a large origin from the medial epicondyle, and, as in rodents, there is no m. flexor digitorum brevis manus so m. flexor digitorum superficialis has expanded to insert also on digit V.

Summary: Primitively m. flexor digitorum superficialis is small and originates from the surface of m. flexor digitorum profundus. This is the case in Marsupials, Xenarthra, and many afrotheres. In *Orycteropus,* Afrosoricida, and Proboscidea m. flexor digitorum superficialis is not always present. The situation is confused in Artiodactyla, but the muscle is definitely different from the condition in *Orycteropus* and afrotheres.

Character 44. Mm. interflexorii

Absent (0), present (1)

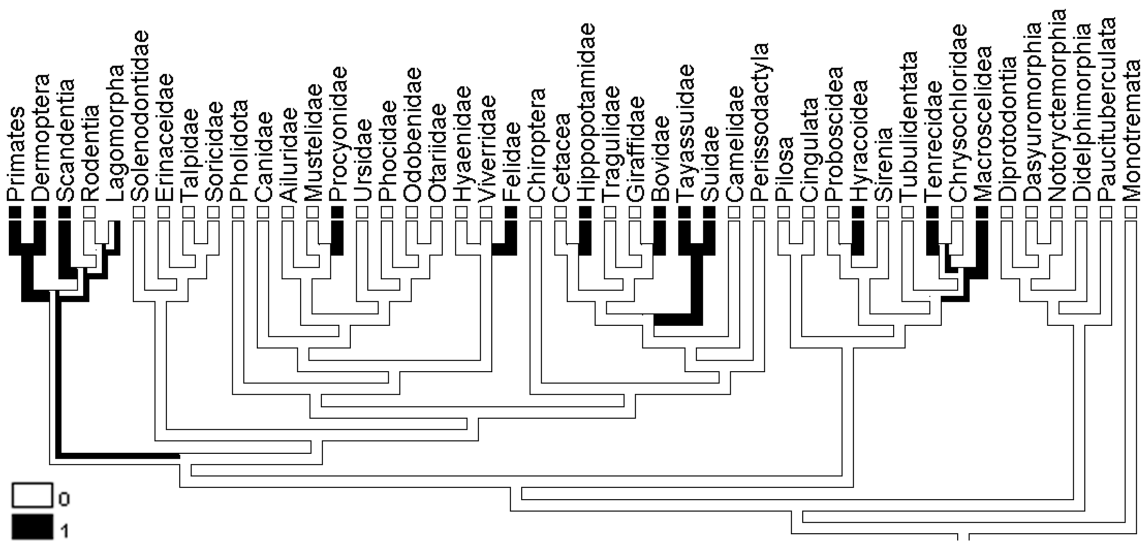

Figure 4.44. Phylogeny depicting character states of mm. interflexorii.

Mm. interflexorii are small connections between m. flexor digitorum superficialis and the bellies or tendons of m. flexor digitorum profundus in the distal forearm (Pitzorno, 1905; Jouffroy, 1971). Such connections seem to be quite variable, and thus mm. interflexorii have been scored as present for a group if a connection between any portion of mm. flexores digitorum has ever been described. The name "interflexorius" has been misused in Canidae for m. flexor digitorum superficialis that originates from m. flexor digitorum profundus (see Spoor & Badoux, 1986b). A slip from m. flexor digitorum profundus to m. flexor digitorum superficialis was seen in *Procyon* and seems to be true mm. interflexorius (Allen, 1882), which to my knowledge has not been described in other carnivores. I observed mm. interflexorii in *Rhynchocyon* and *Heterohyrax*. They have also been observed in *Tenrec* and *Setifer* (Dobson, 1882). Mm. interflexorii are also present in Dermoptera, Scandentia, and Primates (Owen, 1866; Champneys, 1871; Murie & Mivart, 1872; Beddard, 1891; Le Gros Clark, 1924, 1926;

Woollard, 1925; Patterson, 1942; Hill, 1959; Schön, 1968; George, 1977). More significant mm. interflexorii are also observed within Artiodactyla, particularly in the Suina and Bovidae and possibly in the Hippopotamidae (Sisson, 1914; Campbell, 1936; Getty, 1975; Kneepkins et al., 1989).

Summary: Mm. interflexorii are not observed in *Orycteropus*, but have been found in Tenrecidae, Hyracoidea, and Macroscelidea, as well as Artiodactyla and Euarchontoglires. Further study and categorization of these connections between mm. flexores digitorum is needed.

Character 45. M. flexor digitorum profundus humeral heads[22]

Number of humeral heads of origin = none (0), one head (1), two heads (2), three heads (3)

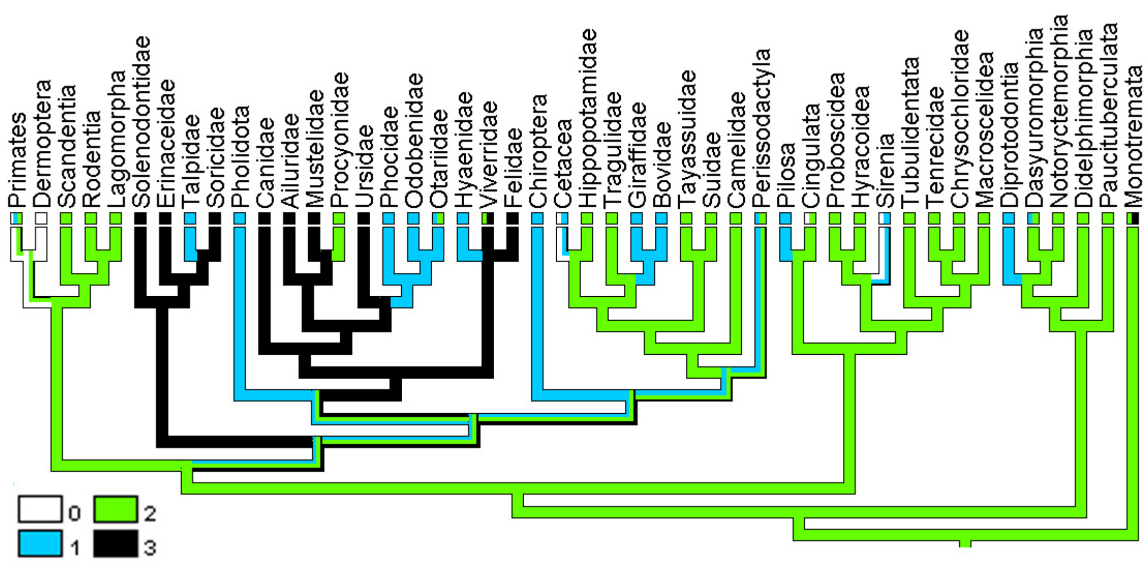

Figure 4.45. Phylogeny depicting character states of humeral heads of origin of m. flexor digitorum profundus.

[22] flexor digitorum profundus + flexor pollicis longus, fléchisseur profond des doigts

Character 46. M. flexor digitorum profundus radial head

Head absent (0), present (1)

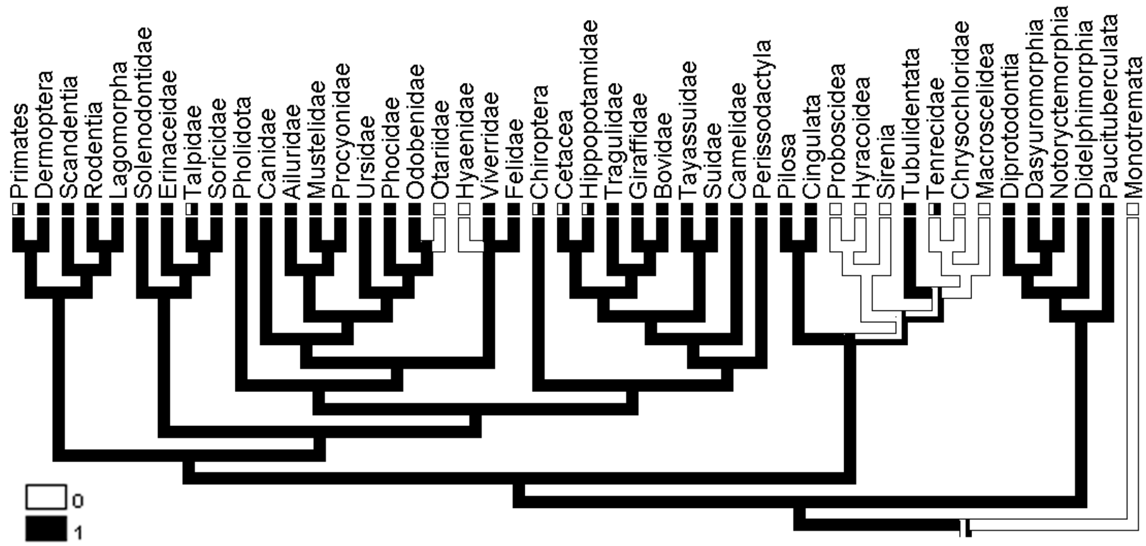

Figure 4.46. Phylogeny depicting character states of radial head of origin of m. flexor digitorum profundus.

M. flexor digitorum profundus is a large muscle with as many as five heads named by Windle (1889), which originate from the medial epicondyle, radius, and ulna. The distal tendons of these heads typically fuse together in the distal part of the forearm, and in the hand send strong tendons to each of the digits (McMurrich, 1903a; Haines, 1950; Jouffroy, 1971). The first of three humeral heads is the robust “condylo-radialis” which joins the radial edge of the flexor digitorum profundus tendon and is innervated by the median nerve. The second humeral head, the “condylo-centralis” head, is slender and fusiform and sends a long narrow tendon to the radial side of the conjoined tendon of m. flexor digitorum profundus and is also innervated by the median nerve. This head is often overlooked (Windle, 1889). The third humeral head, the “condylo-ulnaris” head, is strong, and is innervated by both ulnar and median nerves. This head seems frequently to give rise to m. flexor digitorum superficialis. Its distal tendon fuses with the ulnar side of the conjoined flexor digitorum profundus tendon. The tripartite division of the humeral heads of m. flexor digitorum profundus has been described as fundamental in mammals and even reptiles, though the three parts may not be completely distinct units and thus not wholely homologous (Windle, 1889; Windle & Parsons, 1901; Straus, 1942). Given this ambiguity, the number of condylar heads was scored as one character.

The radial head, “radialis,” is innervated by the median nerve and corresponds to m. flexor pollicis longus of humans. The ulnar head, “ulnaris,” is innervated by the ulnar nerve (Windle, 1889; Windle & Parsons, 1901). This head is always present, and is the only portion of m. flexor digitorum profundus in humans.

Straus (1942) distinguished the three possible condylar heads of m. flexor digitorum profundus from the deeper radial and ulnar heads for developmental reasons, but all the heads of m. flexor digitorum profundus typically fuse into a single, strong tendon at the carpus, which then divides in the manus to serve each of the digits (McMurrich, 1903b; Jouffroy, 1971). This is the case in *Zaglossus* and *Didelphis* and most other mammals, including *Orycteropus* (Coues, 1872; Allen, 1912; Straus, 1942). M. flexor pollicis longus is differentiated in very few mammals, but represents the “radialis” portion of m. flexor digitorum profundus that typically serves the pollex (McMurrich, 1903a; Diogo & Abdala, 2010). In some primates, the tendons of m. flexor digitorum profundus remain individual, and m. flexor pollicis longus may be fully differentiated allowing additional individual control of the digits (Standring et al., 2005).

Determining the true conformation of the heads of m. flexor digititorum profundus in each group of mammals is extremely difficult. There is substantial variation described in the anatomical literature, even for the same genus. It is possible that this muscle is extremely variable, or that researchers did not carefully trace and separate the different heads of origin. My best determination for each group follows, but the heads of m. flexor digitorum profundus should be studied further.

In the Monotremata, there are two or three heads from the medial epicondyle, and one from the ulna (Mivart, 1866; Coues, 1870; Allen, 1912; Howell, 1936). The heads are generally difficult to separate and appear to be one flexor mass (Windle, 1889).

In Marsupialia, there is a head from the ulna and one from the radius, though the number of heads from the medial epicondyle varies. In the Didelphidae and Notoryctidae there are two heads from the medial epicondyle, as in *Caenolestes*, which also has an additional belly from the ulna (Coues, 1872; McMurrich, 1903a; Osgood, 1921; Stein, 1981). In the Dasyuridae, there are one or two heads from the medial epicondyle (Cunningham, 1882; MacCormick, 1886; Jones, 1949), whereas in Diprotodontia there is typically only one head from the medial epicondyle (Parsons, 1896b; Hopwood, 1974; Harvey & Warburton, 2010; Warburton, 2011).

As in many of the marsupials, *Orycteropus* has two heads from the medial epicondyle, one from the radius, and one from the ulna (Galton, 1870). Both *Setifer* and *Tenrec* show the same pattern as *Orycteropus* (Dobson, 1882). I observed the same situation in *Potamogale*, but a radial head has not been previously described in this genus or in many other tenrecs and was also absent in my specimen of *Microgale* (Dobson, 1883; Verheyen, 1961; Jullien, 1967). Chrysochlorids, macroscelidids, hyracoids, and proboscideans also lack a radial head (Miall & Greenwood, 1878a; Dobson, 1883; Shindo & Mori, 1956a; Nielsen, 1965). It is unclear what heads are present in sirenians; either an ulnar head or one from the medial epicondyle appears to be present (Murie, 1872a; Domning, 1977, 1978).

One of the humeral heads is entirely tendinous in *Calcochloris*. In the moles *Scapanus* and *Neurotrichus* there is a strong ligament associated with the proximal end of m. flexor digitorum profundus which may be homologous with an epicondylar head of m. flexor digitorum profundus. This "flexor ligament" is said to transfer humeral rotation to the hand, flexing the digits, and thereby preventing humeral rotation from fracturing the elbow (Reed, 1951). The tendinous epicondylar head of m. flexor digitorum profundus in *Calcochloris* may accomplish a similar task.

Within Xenarthra, the Pilosa have one head from the medial epicondyle, one from the radius, and one from the ulna (Galton, 1869b; Humphry, 1869b; Macalister, 1869a). The situation is unclear in the Cingulata; all species seem to have two heads from the ulna and one from the radius, but some genera may also have two or three heads from the medial epicondyle (Galton, 1869a; Murie, 1872b; Macalister, 1875a; Linkinhoker, 1997).

Erinaceidae, Soricidae, and Solenodontidae have three heads from the medial epicondyle, one from the ulna, and one from the radius (Dobson, 1881a, 1882b; Parsons, 1898a; Allen, 1910; Reed, 1951; Sharma, 1958; Gugler, 1959; Neveu & Gasc, 2002). The Talpidae have a "flexor ligament" which may represent a vestigial head from the medial epicondyle. Talpids usually also have a head from the medial epicondyle (although this can be replaced by another ulnar head), two heads from the ulna, and sometimes a radial head (Reed, 1951; Whidden, 2000).

In Chiroptera, there is either a single head from the medial epicondyle (Vaughan, 1959; Vaughan & Bateman, 1970; Norberg, 1972), or one each from the medial epicondyle, ulna, and radius (Humphry, 1869a; Altenbach, 1979). Three heads —one head each from the medial epicondyle, ulna, and radius-- are also seen in *Manis* (Humphry, 1869b).

In *Tapirus*, there are two heads from the medial epicondyle, one from the ulna, and one from the radius (Windle & Parsons, 1901; Campbell, 1936). The heads are reduced in *Equus* and *Dicerorhinus*, both genera seeming to lack one of the heads from the medial epicondyle (Beddard & Treves, 1889; Windle & Parsons, 1901).

In the Felidae, Viverridae, Canidae, Ursidae, Ailuridae, and Mustelidae, all three of the heads from the medial epicondyle are present, as well as the ulnar and radial heads (Mivart, 1882; Kelley, 1888; Reighard & Jennings, 1901; Hall, 1926; Davis, 1964; Getty, 1975; Leach, 1977; Feeney, 1999; Fisher et al., 2009; Julik et al., 2012). In Hyaenidae, there is a single head from the medial epicondyle and the ulnar head is doubled (Watson & Young, 1879; Young & Robinson, 1889; Spoor & Badoux, 1986a). Similarly, in *Procyon*, there are two heads from the medial epicondyle and the ulnar head is partially subdivided (Allen, 1882). In the pinnipeds, most often there is one head from the medial epicondyle, one from the radius, and one from the ulna (Murie, 1872d; Howell, 1929).

In the Camelidae, Suina, Tragulidae, and possibly Hippopotamidae, there are two heads of origin from the medial epicondyle, one from the ulna, and one from the radius (Sisson, 1914; Campbell, 1936; Smuts & Bezuidenhout, 1987; Kneepkins et al., 1989). In most of the ruminants, however, there is only a single head of origin from the medial epicondyle (Bell, 1876; Windle & Parsons, 1901; Sisson, 1914).

In Cetacea, m. flexor digitorum profundus is described only in a few genera, with the most extensive origin being one head from each of the medial epicondyle, ulna, and radius in *Physeter* (Cooper et al., 2007). More typically, there is a single origin from the ulna (Carte & Macalister, 1868; Cooper et al., 2007), or the muscle is absent (Howell, 1930; Cooper et al., 2007).

In Scandentia, information is mixed, but it seems most likely that there are two heads from the medial epicondyle, one from the ulna, and one from the radius (Le Gros Clark, 1924; George, 1977).

In the strepsirrhine primates, there is one head from the medial epicondyle, one or two heads from the ulna, and one from the radius (Owen, 1866; Murie & Mivart, 1872; Soligo, 2005). In *Tarsius* and *Callimico*, there may also be an additional head from the medial epicondyle (Woollard, 1925; Hill, 1959). The muscle is much reduced in origin in the Cattarhini; typically there are no heads from the medial epicondyle (Dobson, 1881b; Patterson, 1942; Miller, 1952; Standring et al., 2005).

In Lagomorpha and Rodentia, there are two heads of origin from the medial epicondyle, one from the ulna, and one from the radius, although the antebrachial origins can be merged together particularly in the Cricetidae (Parsons, 1898b; Howell, 1932; Greene, 1935; Wood & White, 1950; Rinker, 1954; Craigie, 1966; Woods, 1972; McEvoy, 1982; Kesner, 1986; Stein, 1986; Ryan, 1989; Thorington et al., 1997).

Sesamoid in the tendon of m. flexor digitorum profundus in fossorial mammals

There is a large sesamoid in the tendon of m. flexor digitorum profundus near the palm in many digging mammals: in *Calcochloris* and other chrysochlorids (Dobson, 1883; Parsons, 1901; Jullien, 1967; Puttick & Jarvis, 1977; Gasc et al., 1986), in the dasypodids *Euphractus* and *Chlamyphorus* (Galton, 1869a), in *Manis* (Humphry, 1869b), in *Notoryctes* (Warburton, 2003) and in *Tachyglossus* (Mivart, 1866). A small sesamoid is found in the tendon of m. flexor digitorum profundus at the base of the pollex in *Ptilocercus* (Le Gros Clark, 1926). In *Orycteropus*, though the tendon is extremely robust and nearly impossible to transect with a scalpel, I did not observe any ossification.

Summary: Three humeral heads are found only in Eulipotyphla and Carnivora. Most mammals, including *Orycteropus* and afrotheres, have two humeral heads of origin of m. flexor digitorum profundus. A radial head of m. flexor digitorum profundus is present in almost all mammals, including *Orycteropus*. However, this head is absent in most afrotheres except some tenrecs.

Character 47. M. flexor carpi ulnaris[23]

Both medial epicondylar and ulnar heads (0), only an ulnar head (1), only a medial epicondylar head (2)

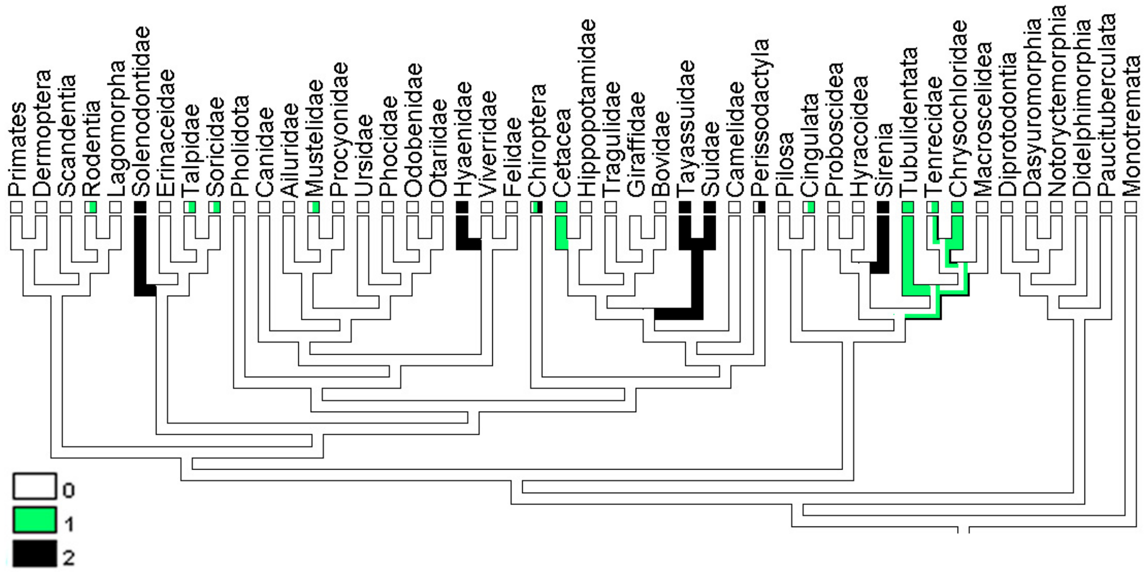

Figure 4.47. Phylogeny depicting character states of m. flexor carpi ulnaris.

[23] cubital interne, fléchisseur cubital du carpe, flexor externis metacarpi, flexor humero-ulnaris, flexor metacarpi externus

M. flexor carpi ulnaris primitively has two heads of origin, one from the medial epicondyle and one from the medial side of the olecranon, which fuse and typically insert on the pisiform (Jouffroy, 1971). This, for example, is seen in Monotremata and in Marsupialia (Mivart, 1866; Macalister, 1870; Coues, 1870, 1872; Cunningham, 1882; Young, 1882; Sidebotham, 1885; MacCormick, 1886; Wilson, 1894; Parsons, 1896b; Allen, 1912; Osgood, 1921; Howell, 1936; Hopwood, 1974; Stein, 1981; Walter, 1988; Warburton, 2003, 2011; Harvey & Warburton, 2010). The ulnar nerve runs along the deep surface of the muscle in *Caenolestes* (Osgood, 1921), *Didelphis* (Coues, 1872), *Petrogale* (Parsons, 1896b), and all afrotheres I dissected, whereas it runs more along the lateral side of the muscle in humans (Standring et al., 2005).

In *Orycteropus*, chrysochlorids, and *Potamogale*, the origin from the medial epicondyle is vestigial or absent (Galton, 1870; Parsons, 1901; Sonntag, 1925; Jullien, 1967; Gasc et al., 1986). Both heads of origin are present in the other tenrecs and in Dobson's (1883) specimen of *Potamogale*, the Macroscelidea, Hyracoidea, and Proboscidea (Miall & Greenwood, 1878a; Dobson, 1883; Windle & Parsons, 1901; Shindo & Mori, 1956a; Verheyen, 1961; Nielsen, 1965; Jullien, 1967; Neveu & Gasc, 2002). In the Sirenia, only the epicondylar origin is present (Murie, 1872a; Domning, 1977, 1978).

In many armadillos the epicondylar origin is vestigial or absent (Galton, 1869a; Murie, 1872b; Macalister, 1875a; Linkinhoker, 1997). The other xenarthrans have both epicondylar and ulnar origins (Galton, 1869b; Humphry, 1869b; Macalister, 1869a).

Both heads of origin are found in many Eulipotyphla (Dobson, 1881a, 1882b, 1883; Parsons, 1898a; Sharma, 1958; Jullien, 1967; Whidden, 2000; Neveu & Gasc, 2002). However, the epicondylar origin is absent in the soricids *Cryptotis* and *Sorex* (Reed, 1951; Gugler, 1959) and some talpids (Dobson, 1883; Whidden, 2000), and the ulnar origin is absent in *Solenodon* (Allen, 1910).

The situation in Chiroptera is also mixed; sometimes both heads are present (Humphry, 1869a; Norberg, 1972), sometimes only the humeral head (Vaughan, 1959; Vaughan & Bateman, 1970), and sometimes only the ulnar head (Vaughan, 1959; Altenbach, 1979). It was scored as polymorphic for all three states.

Both heads are generally found in Perissodactyla (Beddard & Treves, 1889; Windle & Parsons, 1901; Sisson, 1914), though the ulnar origin may be absent in *Tapirus* (Windle & Parsons, 1901; Campbell, 1936; Bressou, 1961).

Both heads of origin are also found in *Manis* and most Carnivora, (Devis, 1868; Humphry, 1869b; Murie, 1872d; Allen, 1882; Mivart, 1882; Kelley, 1888; Reighard & Jennings, 1901; Fisher, 1942; Davis, 1964; Getty, 1975; Feeney, 1999; Fisher et al., 2009; Julik et al., 2012). In Hyaenidae, the ulnar origin may be absent (Watson & Young, 1879; Spoor & Badoux, 1986a), and in the mustelids the humeral origin is absent in some species (Hall, 1926). Also interesting is that the two heads of m. flexor carpi ulnaris are completely separate muscles inserting on the pisiform in some carnivorans, such as *Civettictis* and *Martes* (Devis, 1868; Leach, 1977).

The muscle is found in all conditions in Artiodactyla. In *Camelus*, both heads are present (Windle & Parsons, 1901; Smuts & Bezuidenhout, 1987). In the Suina, only the origin from the medial epicondyle is present (Windle & Parsons, 1901; Sisson, 1914; Campbell, 1936; Kneepkins et al., 1989). I did not observe an ulnar origin in *Tragulus*, but it is apparently usually present in that genus and in other ruminants and hippopotamids (Windle & Parsons, 1901; Beddard, 1909; Campbell, 1936; Getty, 1975; Fisher et al., 2007). Only the ulnar origin is found in Cetacea (Carte & Macalister, 1868; Cooper et al., 2007).

Both heads are found in Dermoptera, Scandentia, and Primates (Owen, 1866; Champneys, 1871; Murie & Mivart, 1872; Primrose, 1899; Le Gros Clark, 1924, 1926; Woollard, 1925; Beattie, 1927; Patterson, 1942; Miller, 1952; Schön, 1968; Hill, 1959; George, 1977; Soligo, 2005; Standring et al., 2005).

Lagomorpha and many rodents also have both heads of origin (Bensley, 1921; Crabb, 1931; Greene, 1935; Wood & White, 1950; Rinker, 1954; Craigie, 1966; McEvoy, 1982; Thorington et al., 1997; Bezuidenhout & Evans, 2005). There are also many rodents lacking the epicondylar origin (Howell, 1932; Young, 1937; Rinker, 1954; Woods, 1972; Stein, 1986; Kesner, 1986; Ryan, 1989).

Summary: *Orycteropus* and many Afrosoricida have a vestigial or absent medial epicondylar origin of m. flexor carpi ulnaris, and this reduction or loss is a tentative synapomorphy for Tubulidentata and Afrosoricida. This is a myological feature shared by few mammals; the epicondylar origin is also lacking in some talpids, soricids, dasypodids, rodents, and cetaceans. Loss of the epicondylar origin of m. flexor carpi ulnaris is not a synapomorphy for Lipotyphla, as *Solenodon* has lost the ulnar origin instead.

Character 48. M. epitrochleo-anconeus[24]

Absent (0), present (1)

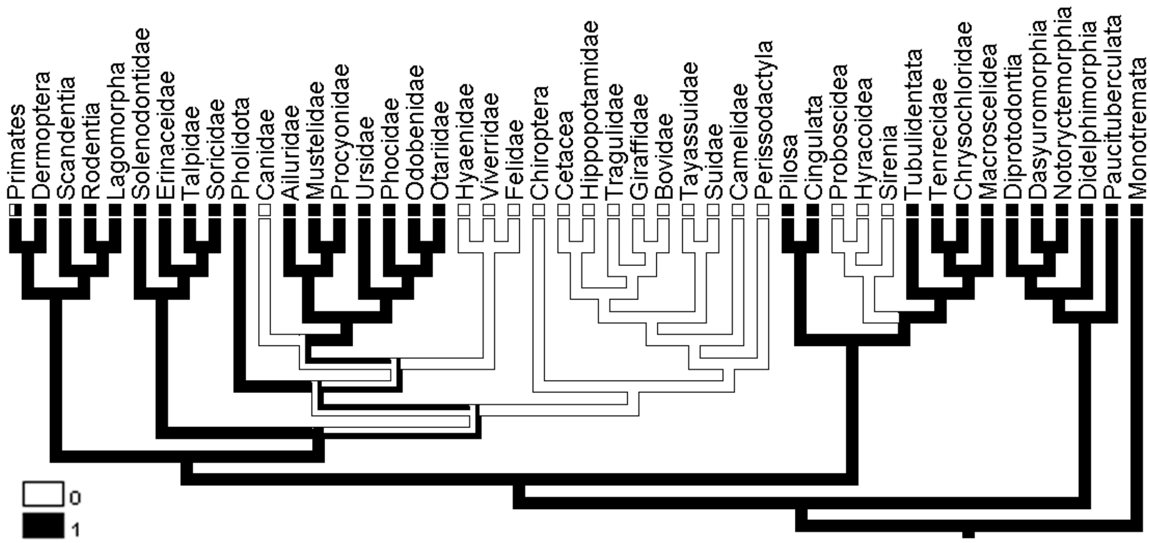

Figure 4.48. Phylogeny depicting character states of m. epitrochleo-anconeus.

M. epitrochleo-anconeus is generally a small muscle in mammals and is often overlooked or confused with m. anconeus (discussed above). It is attached to the medial epicondyle and medial side of the olecranon (Straus, 1942; Jouffroy, 1971). M. epitrochleo-anconeus is not mentioned in the Nomina Anatomica Veterinaria (2005), so I selected a term commonly utilized in the literature and in the Traité de Zoologie (Jouffroy, 1971).

In Monotremata, a muscle at the medial elbow is known by a variety of names, but seems to be homologous with the epitrochleo-anconeus of other mammals, in view of its typical attachments to the medial epicondyle and medial surface of the olecranon (Mivart, 1866; Coues, 1870; Howell, 1936; Walter, 1988). Oddly, however, the innervation is radial in monotremes (Westling, 1889; McKay, 1895). In marsupials and

[24] anconeus, anconeus epitrochlearis, anconeus internus, anconeus medialis, anconaeus minimus, antanconaeus, condylo-olecranon, épitrochléo-olécrânien, flexor humero-ulnaris, triceps anconeus, triceps brachii caput mediale accessorium, triceps brachii medial head minor

in placental mammals, m. epitrochleo-anconeus is always innervated by the ulnar nerve, which passes into the forearm by travelling deep to the muscle (Cunningham, 1882; Wilson, 1894; Straus, 1942).

In all marsupials, the muscle is well marked and fleshy (Macalister, 1870; Coues, 1872; Cunningham, 1882; Young, 1882; Sidebotham, 1885; MacCormick, 1886; Wilson, 1894; Parsons, 1896b; Osgood, 1921; Sonntag, 1922b; Jones, 1949; Stein, 1981; Warburton, 2003; Harvey & Warburton, 2010).

The muscle is similarly robust in Tubulidentata, Afrosoricida, and Macroscelidea (Humphry, 1868; Galton, 1870; Parsons, 1901; Sonntag, 1925; Verheyen, 1961; Jullien, 1967; Puttick & Jarvis, 1977; Neveu & Gasc, 2002). In the paenungulates, however, m. epitrochleo-anconeus is probably absent or usually absent. It was absent in my specimen of *Heterohyrax* but present in *Procavia*, although not noted by other authors for *Procavia* (Murie & Mivart, 1865; Windle & Parsons, 1901). According to Windle & Parsons (1901), the muscle is present in *Elephas*, but it is not noted by other authors (Miall & Greenwood, 1878a; Shindo & Mori, 1956a; Nielsen, 1965). The muscle is also not noted for Sirenia (Murie, 1872a; Domning, 1977, 1978).

A typical m. epitrochleo-anconeus is found in Xenarthra (Galton, 1869a, 1869b; Humphry, 1869b; Macalister, 1869a, 1873; Murie, 1872b; Miles, 1941; Linkinhoker, 1997), and in all eulipotyphlans (Dobson, 1882b, 1883; Parsons, 1898a; Reed, 1951; Sharma, 1958; Gugler, 1959; Jullien, 1967; Whidden, 2000; Neveu & Gasc, 2002).

M. epitrochleo-anconeus is absent in Artiodactyla and Cetacea (Windle & Parsons, 1901; Cooper et al., 2007). It is absent in Perissodactyla, except for one specimen of *Tapirus* in which it is represented by a "strong fascial band" associated with

m. flexor carpi ulnaris (Campbell, 1936). M. epitrochleo-anconeus is not mentioned in descriptions and presumably is absent in Chiroptera.

M. epitrochleo-anconeus is found in *Manis* (Humphry, 1869b). It is present in the Ursidae, Procyonidae, Ailuridae, Mustelidae, and pinnipeds (Murie, 1872d; Allen, 1882; Kelley, 1888; Beddard, 1900; Hall, 1926; Howell, 1929; Fisher, 1942; Davis, 1964; Fisher et al., 2009). In the feliforms it is not described, except for a "few fibers on the medial elbow" in *Felis* (Getty, 1975). M. epitrochleo-anconeus is not described in Hyaenidae and presumably is absent.

M. epitrochleo-anconeus is typical in Rodentia, Scandentia, and Dermoptera (Parsons, 1898b; Le Gros Clark, 1924, 1926; Howell, 1932; Young, 1937; Davis, 1938; Wood & White, 1950; Rinker, 1954; Haines, 1955; Woods, 1972; George, 1977; McEvoy, 1982; Kesner, 1986; Stein, 1986; Ryan, 1989; Thorington et al., 1997; Diogo & Abdala, 2010). It is small and thin in Lagomorpha (Bensley, 1921; Craigie, 1966).

Many primates have m. epitrochleo-anconeus, though it is often not described and is presumably absent in some primates, as it is in humans (Patterson, 1942; Miller, 1952; Schön, 1968; Soligo, 2005; Standring et al., 2005).

Summary: M. epitrochleo-anconeus is present in *Orycteropus* and most other mammals. It is absent in Paenungulata, Artiodactyla, Perissodactyla, Chiroptera, and many Carnivora. Loss of the muscle seems to be associated with flying or cursorial locomotion.

Character 49. M. pronator quadratus

Absent or vestigial (0), present (1)

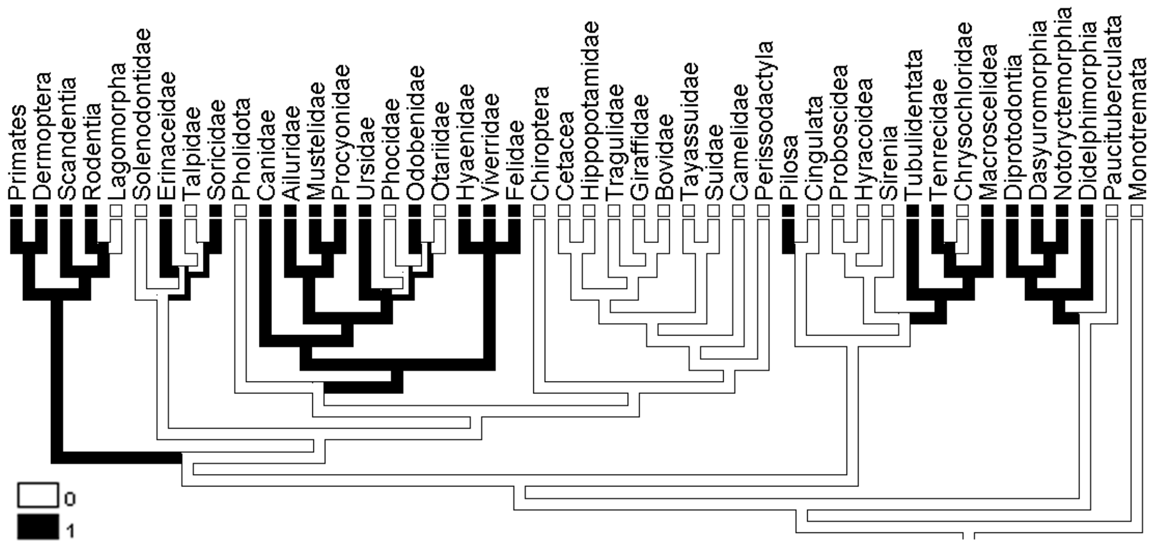

Figure 4.49. Phylogeny depicting character states of m. pronator quadratus.

M. pronator quadratus spans between the radius and ulna deep to m. flexor digitorum profundus (Straus, 1942). It can be found proximally, distally, or filling the entire interosseous space (Macalister, 1869b; Jouffroy, 1971).

The muscle is absent in monotremes (Mivart, 1866; Howell, 1936; Straus, 1942). It is also absent in *Caenolestes* (Osgood, 1921). In the Didelphimorphia, *Notoryctes*, most Dasyuromorphia, and the diprotodont families Macropodidae and Vombatidae, the muscle covers the distal third or half of the forearm (Macalister, 1870; Cunningham, 1882; Sidebotham, 1885; Parsons, 1896b; Sonntag, 1922b; Jones, 1949; Hopwood, 1974; Stein, 1981; Linkinhoker, 1997; Warburton, 2003; Harvey & Warburton, 2010). The pronator quadratus is poorly developed in the dasyuromorph *Thylacinus* and in the other diprotodonts (Cunningham, 1882; Young, 1882; Sonntag, 1922b).

M. pronator quadratus has been described as small in *Orycteropus* (Humphry, 1868), but I found it to be a fairly large triangle of tendinous muscle covering almost the entire radius and the distal ulna. The muscle is absent or extremely vestigial in chrysochlorids (Parsons, 1901; Jullien, 1967), but covers the proximal third of the forearm in tenrecs and macroscelidids (Verheyen, 1961; Jullien, 1967; Neveu & Gasc, 2002). The muscle is absent or vestigial in paenungulates (Windle & Parsons, 1901; Nielsen, 1965).

M. pronator quadratus is quite diverse in Xenathra. It is small and quite distal in the sloths, but covers the entire radius and ulna in the anteaters (Galton, 1869b; Humphry, 1869b; Macalister, 1869a). In the armadillos it is absent or exceedingly feeble (Galton, 1869a; Murie, 1872b; Macalister, 1875a; Windle & Parsons, 1899a).

M. pronator quadratus is found in Erinaceidae and Soricidae, but it is absent in Talpidae except *Neurotrichus* and is not described for *Solenodon* (Dobson, 1882b; Allen, 1910; Reed, 1951; Sharma, 1958; Gugler, 1959; Jullien, 1967; Whidden, 2000; Neveu & Gasc, 2002).

M. pronator quadratus is also absent in Chiroptera, Perissodactyla, *Manis*, Artiodactyla, and Cetacea (Humphry, 1869a,b; Windle & Parsons, 1901; Straus, 1942; Jouffroy, 1971; Bressou, 1961; Kneepkins et al., 1989; Cooper et al., 2007; Fisher et al., 2007; Budras & Sack, 2012).

In Carnivora, the muscle is found on the distal third or half of the forearm (Allen, 1882; Mivart, 1882; Young & Robinson, 1889; Reighard & Jennings, 1901; Hall, 1926; Fisher, 1942; Davis, 1964; Getty, 1975; Leach, 1977; Feeney, 1999; Fisher et al., 2009;

Julik et al., 2012). The muscle is quite weak in pinnipeds (Humphry, 1868; Murie, 1872d; Howell, 1929).

M. pronator quadratus is typically found on the distal forearm in rodents, but of course there is a diversity of locations for the muscle and it is vestigial in the more saltatorial rodents (Parsons, 1898b; Howell, 1932; Greene, 1935; Young, 1937; Woods & White, 1950; Rinker, 1954; Woods, 1972; McEvoy, 1982; Kesner, 1986; Stein, 1986; Thorington et al., 1997; Bezuidenhout & Evans, 2005). The muscle is not mentioned and presumably is absent in Lagomorpha.

Scandentia and Primates have a well-developed m. pronator quadratus that is on the distal quarter or fifth of the forearm (Owen, 1866; Murie & Mivart, 1872; Primrose, 1899; Le Gros Clark, 1924, 1926; Woollard, 1925; Beattie, 1927; Patterson, 1942; Straus, 1942; Miller, 1952; Haines, 1955; Hill, 1959; Schön, 1968; George, 1977; Soligo, 2005; Standring et al., 2005). The muscle is "as in man" in Dermoptera (Champneys, 1871).

Summary: M. pronator quadratus is present in *Orycteropus* and many other mammals. It is absent or vestigial in the fossorial mammals Talpidae, Pholidota, Cingulata, and Chrysochloridae, and also in Artiodactyla, Perissodactyla, and Paenungulata. This feature does not support Ungulata or Lipotyphla.

M. MANUS GROUP – MEDIAN and ULNAR NERVES

The muscles of the mammalian hand are quite simply arranged, and have been elegantly described (Young, 1880; Cunningham, 1882). From superficial to deep, the possible layers of the hand are as follows: 1- m. palmaris brevis, superficial to the superficial branch of the ulnar nerve, and palmar aponeurosis; 2- mm. flexor digitorum breves manus; 3- branches of median and ulnar nerve; 4- tendons of mm. flexor digitorum superficialis and flexor digitorum profundus and mm. lumbricales; 5- mm. contrahentes, superficial to the deep branch of the ulnar nerve; 6- mm. abductor digiti minimi, abductor pollicis brevis, and flexor digitorum breves profundus; 7- mm. intermetacarpales. However, despite the simple arrangement of these muscles in less derived mammals, much of the anatomical literature leaves one feeling confused regarding the intrinsic muscles of the hand. The terminology is extremely varied and often not accompanied by an illustration, leaving the reader uncertain as to the actual homology of the muscles discussed. Also, a focus on the hand anatomy of humans and other primates is misleading; the differentiation of muscles within the primate hand has led to application of special names, but these should not be used for mammals with less derived hand musculature.

Therefore, several aspects of mammalian hand musculature cannot be reliably discussed. For example, there may be both mm. abductor digiti minimi and abductor pollicis brevis present on the margins of the palm (Haines, 1955; Diogo & Abdala, 2010). Due to the variation in terminology used for the muscles of the hand, what is truly m. abductor digiti minimi or m. abductor pollicis brevis is difficult to determine. This is especially true in mammals with reduced or absent digits. Until further dissections can be carried out, even the simple presence or absence of these muscles cannot be reliably scored. The other intrinsic muscles of the hand are discussed below.

Character 50. M. palmaris brevis

Absent (0), present (1)

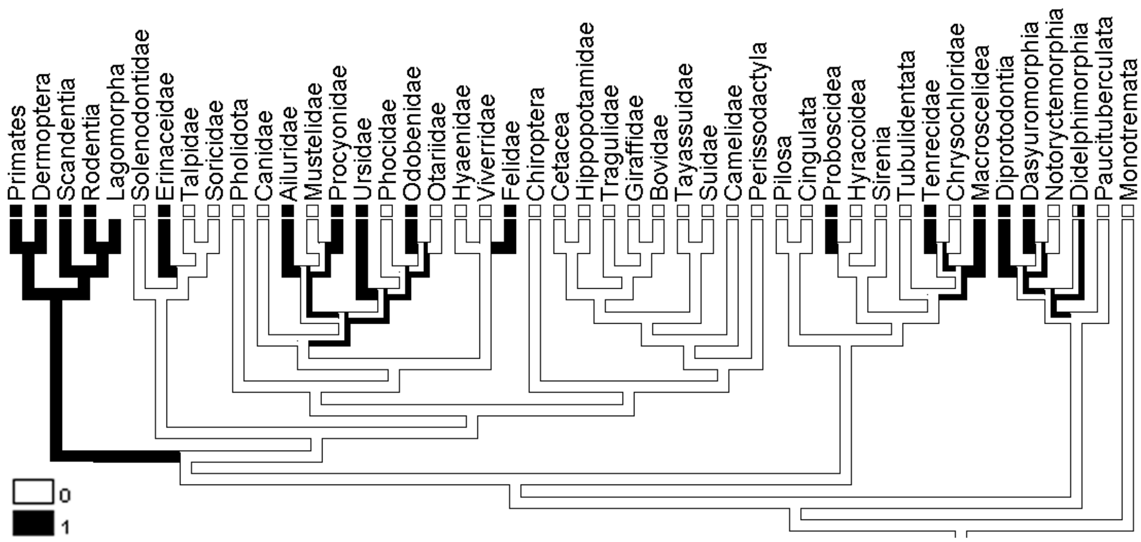

Figure 4.50. Phylogeny depicting character states of m. palmaris brevis.

M. palmaris brevis is the only muscle lying superficial to the superficial branch of the ulnar nerve (McMurrich, 1903b). This muscle is very small and often damaged during the process of skinning or is overlooked during dissection, so there is not always reliable information available in the literature.

The muscle is never mentioned in descriptions of Monotremata, but is “large” in the diprotodont *Petrogale* (Parsons, 1896b), and present in the dasyuromorphs *Dasyurus*, *Sarcophilus*, and *Thylacinus* (Macalister, 1870; Cunningham, 1882; MacCormick, 1886). It might also be present in *Didelphis* (Brandell, 1965). It is possible that the muscle described as m. palmaris brevis for these animals actually represents m. flexor digitorum brevis manus, which is otherwise absent.

In Scandentia, there are many muscle fibers found in the hypothenar pad and a smaller set for the thenar pad, which must control the shape of the pads (Le Gros Clark, 1924, 1926; Haines, 1955; George, 1977). I observed similar muscle fibers in the greatly enlarged hypothenar pads of *Potamogale* and *Elephantulus*, and possibly *Petrodromus* (Haines, 1955). Presumably these muscle fibers all represent m. palmaris brevis. There may also be m. palmaris brevis in *Elephas* (Shindo & Mori, 1956a).

M. palmaris brevis is found within Carnivora in Felidae, Ursidae, Ailuridae, Procyonidae, and Odobenidae. It generally originates from the flexor retinaculum or palmar fascia and inserts on the hypothenar pad or at the base of digit V (Murie, 1872d; Allen, 1882; Davis, 1964; Fisher et al., 2009; Julik et al., 2012).

The muscle is often seen in Primates; it generally originates from the palmar fascia or flexor retinaculum and inserts on the hypothenar eminence (Murie & Mivart, 1872; Dobson, 1881b; Woollard, 1925; Beattie, 1927; Miller, 1952; Schön, 1968; Soligo, 2005; Standring et al., 2005). The muscle is also present in *Cynocephalus* (Diogo & Abdala, 2010). In some rodents m. palmaris brevis is extensive and contains one or more cartilaginous splints. It generally originates from the falciform bone and inserts on the hypothenar pad (Parsons, 1898b; Rinker, 1954; Kesner, 1986).

Within Eulipotyphla, the only description is for *Echinosorex*, in which m. palmaris brevis originates from the pisiform and inserts on the palmar fascia (Dobson, 1881a). The muscle seems to be absent in Tubulidentata, Hyracoidea, Chrysochloridae, Sirenia, Xenarthra, Chiroptera, Perissodactyla, Pholidota, Artiodactyla, and Cetacea.

Summary: M. palmaris brevis is not often found in Mammalia, though it is widely present in Euarchontoglires. It is absent in *Orycteropus* but is found in a few afrotheres.

Character 51. M. flexor digiti brevis manus – digit I

Absent (0), present (1)

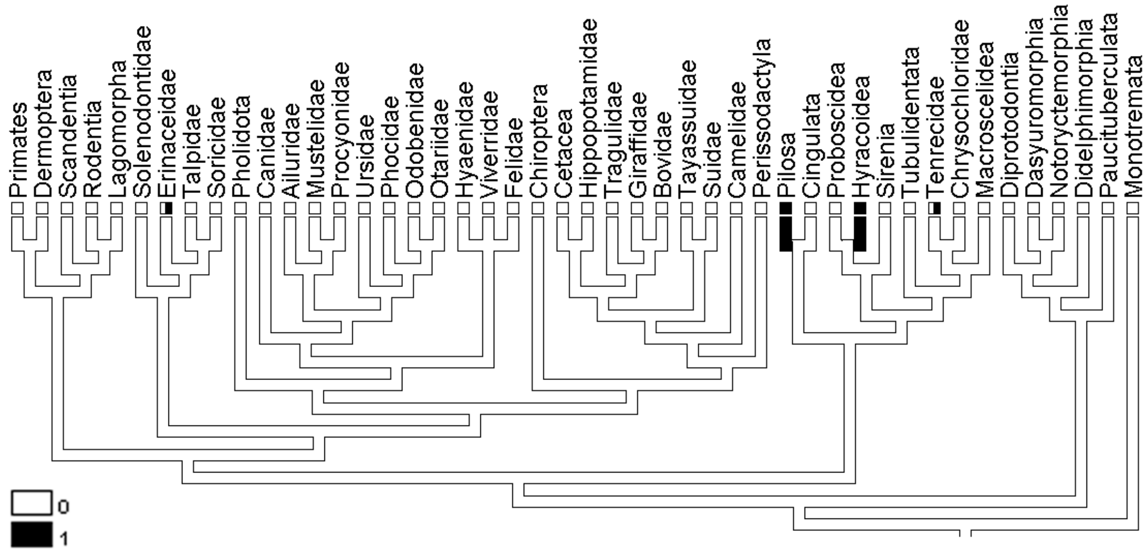

Figure 4.51. Phylogeny depicting presence of m. flexor digiti brevis manus – digit I.

Character 52. M. flexor digiti brevis manus – digit II

Absent (0), present (1)

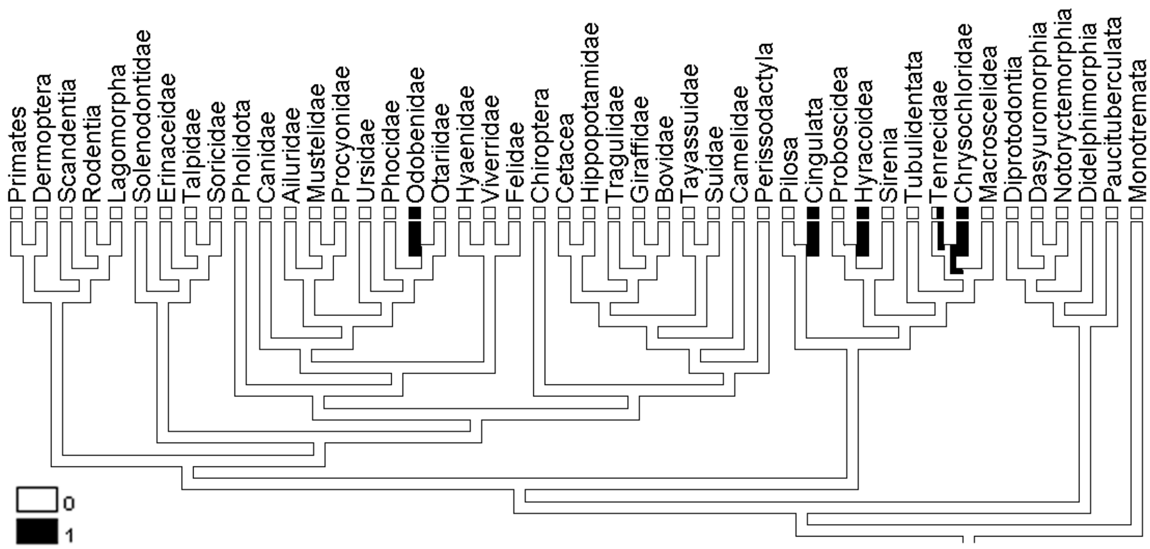

Figure 4.52. Phylogeny depicting presence of m. flexor digiti brevis manus – digit II.

Character 53. M. flexor digiti brevis manus – digit IV

Absent (0), present (1)

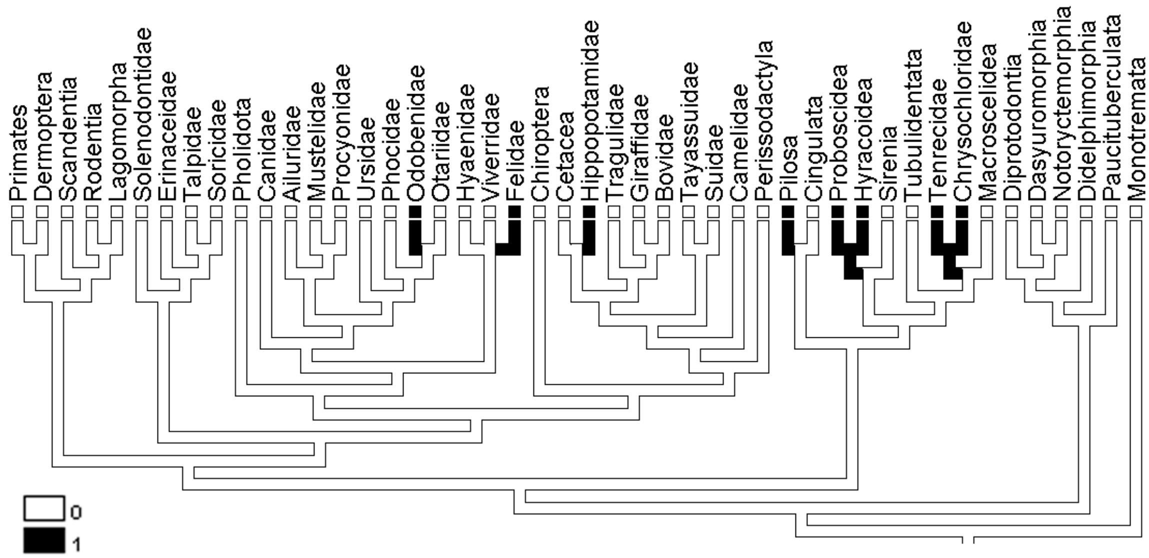

Figure 4.53. Phylogeny depicting presence of m. flexor digiti brevis manus – digit IV.

Character 54. M. flexor digiti brevis manus – digit V

Absent (0), present (1)

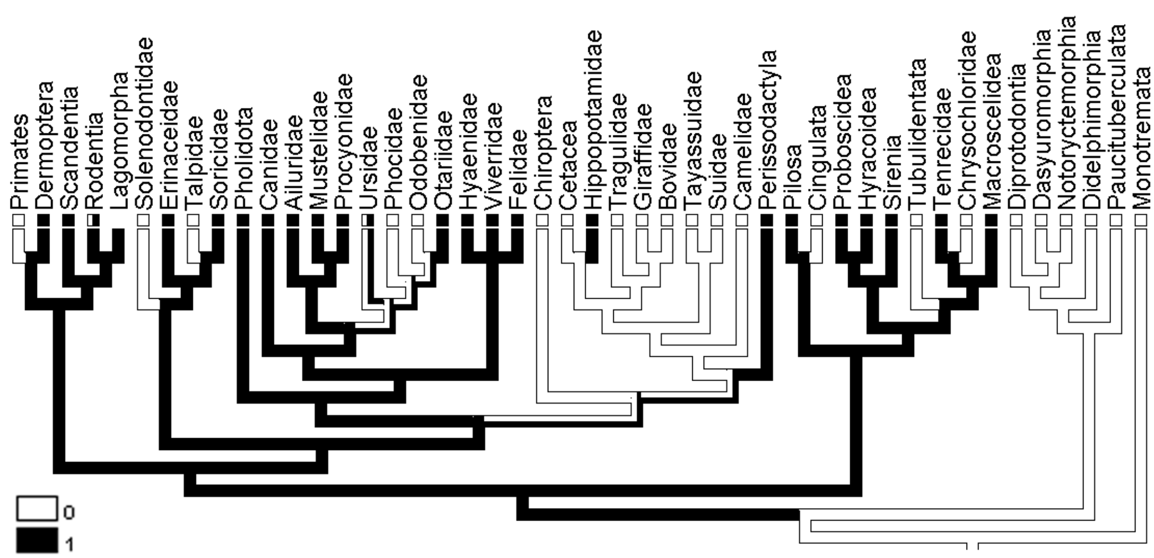

Figure 4.54. Phylogeny depicting presence of m. flexor digiti brevis manus – digit V.

Mm. flexor digitorum breves manus are similar to mm. flexores breves superficiales of reptiles and may incorporate these reptilian muscles (Straus, 1942; Abdala & Diogo, 2010). The small, fan-shaped muscle generally takes origin from the flexor retinaculum or the palmar aponeurosis (Jouffroy, 1971). It can be overlooked during dissection due to its superficial position or confusion with m. palmaris brevis. It covers the branches of the median nerve, which I find innervating the muscles in afrotheres. It is usually present as a single belly, m. flexor digiti brevis manus, whose insertion typically forms a perforated tendon through which passes the tendon of m. flexor digitorum profundus for digit V. There may also be other small bellies, collectively mm. flexor digitorum breves manus, with tendons to digits I, II, or IV which insert on the surface of the tendons of m. flexor digitorum superficialis or around the metacarpal-phalangeal joint (Jouffroy, 1971). There may be an inverse relationship with the size of m. flexor digitorum superficialis. Mm. flexor digitorum breves manus was scored for its maximum extent in each group, and each small fleshy belly was scored individually.

There are no mm. flexor digitorum breves manus in Monotremata or in Marsupialia. Brandell (1965) referenced a "flexor brevis manus" innervated by the superficial branch of the ulnar nerve in *Didelphis*, but this muscle is probably m. palmaris brevis. Also, McMurrich (1903) considered the perforated flexor tendon to digit V to originate from m. palmaris longus in *Didelphis*, which sounds reminiscent of mm. flexor digitorum brevis manus but contradicts other descriptions (Coues, 1872; Stein, 1981).

Mm. flexor digitorum breves manus is variable in Xenarthra, found in *Choloepus* and *Cyclopes* for digits I-IV-V and in *Myrmecophaga* for digits IV-V (Galton, 1869b), and seems to be absent in Cingulata except for digit II (Murie, 1872b).

In many afrotheres, the muscle is much enlarged. In the hyracoids, there is possibly a vestigial belly for the pollex and robust bellies for digits II-IV-V, and the muscle is innervated by the median nerve (Murie & Mivart, 1865). I also observed mm. flexor digitorum brevis manus for digits II-IV-V in *Potamogale*, and digits I-IV-V in *Microgale*. Other anatomists have noted fewer bellies in tenrecids (Verheyen, 1961; Jullien, 1967; Neveu & Gasc, 2002). Descriptions of chrysochlorid anatomy report no intrinsic muscles of the hand, but in *Calcochloris* I found probable mm. flexor digitorum breves manus made of only tendinous fibers, serving digits II and IV. There were no fleshy bellies present in *Orycteropus* either, but it is possible that mm. flexor digitorum breves manus are be incorporated in the thickened palmar aponeurosis. Nevertheless, the feature has been scored as absent in this genus as no muscle fibers were observed during dissection. Mm. flexor digitorum brevis manus are found for at least digits IV-V in elephants, and digit V in sirenians (Miall & Greenwood, 1878a; Windle & Parsons, 1901; Shindo & Mori, 1956a; Nielsen, 1965; Domning, 1978). Macroscelidids have only one m. flexor digiti brevis manus forming a perforated tendon for digit V, although this is absent in *Rhynchocyon* (Jullien, 1967).

In Erinaceidae and Soricidae, the muscle forms a perforated tendon for at least digit V (Dobson, 1882b; Reed, 1951; Haines, 1955; Sharma, 1958; Jullien, 1967; Neveu & Gasc, 2002). The muscle is not mentioned in *Solenodon* and is absent in Talpidae

(Jullien, 1967; Whidden, 2000). The muscle is also absent in Chiroptera, Primates, and Cetacea.

Carnivores and *Manis* generally also have m. flexor digiti brevis manus forming the perforated tendon for digit V (Devis, 1868; Humphry, 1869b; Murie, 1872d; Allen, 1882; Kelley, 1888; Hall, 1926; Getty, 1975; Spoor & Badoux, 1986a; Fisher et al., 2009). The muscle is generally absent in the mustelids, but there are reports of an additional belly to digit IV in some feliforms (Davis, 1964; Haines, 1950; Jouffroy, 1971; Julik et al., 2012). In *Felis*, the muscle is supplied by a special branch of the deep ulnar nerve (Haines, 1950).

M. flexor digiti brevis manus is found inserting on at least digit V in *Tapirus* but is not noted in other perissodactyls (Campbell, 1936; Bressou, 1961). In Scandentia, m. flexor digiti brevis manus forms the perforated tendon for digit V (Le Gros Clark, 1924, 1926; Haines, 1955; George, 1977).

Mm. flexor digitorum breves manus are found in Hippopotamidae for digits IV-V, innervated by the superficial branch of the ulnar nerve, but they are absent in other artiodactyls (Campbell, 1936; Kneepkins et al., 1989; Fisher et al., 2007).

Within Rodentia and Dermoptera, it is difficult to know whether the muscle is present given some issues with terminology of the intrinsic hand musculature (Diogo & Abdala, 2010). M. flexor digiti brevis manus inserting on the fascia of digit V seems to be present in some species of Cricetidae (Rinker, 1954; Stein, 1986). Mm. flexor digitorum breves manus are not mentioned and presumably are absent in Lagomorpha.

Summary: There is an unusual distribution of mm. flexor digitorum breves manus. The muscles are absent in *Orcyteropus* and many other mammals including Artiodactyla, Marsupialia, and Monotremata. However, mm. flexor digitorum breves manus seem to be best developed within the Afrotheria clade. Further study of mm. flexor digitorum breves manus is needed.

Character 55. Mm. lumbricales

Absent (0), fewer than four lumbricales present (1), four lumbricales (2)

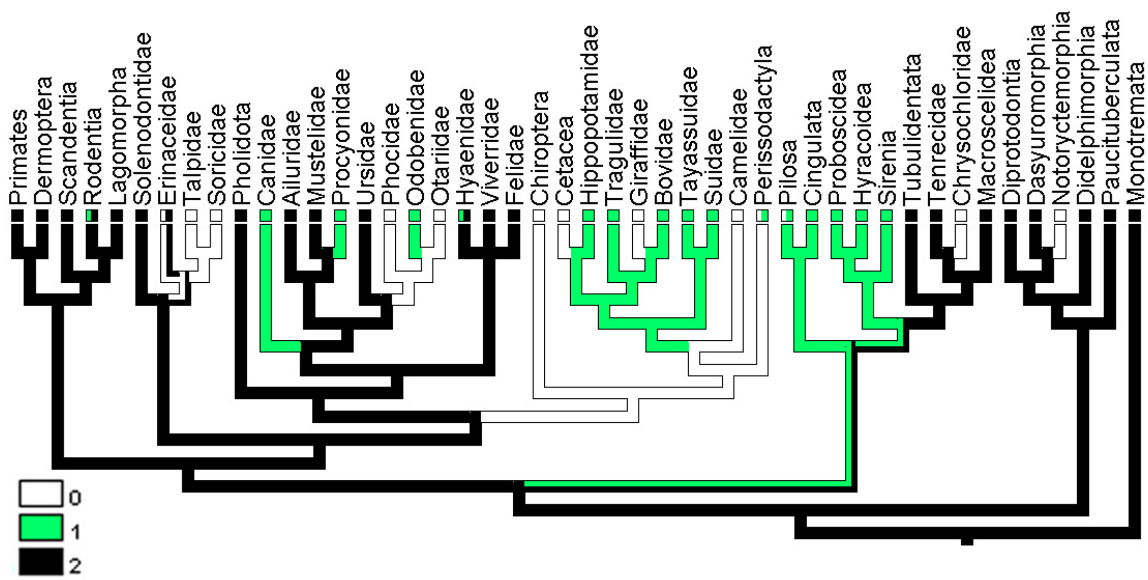

Figure 4.55. Phylogeny depicting character states of mm. lumbricales.

Typically, there are four mm. lumbricales originating from between the tendons of m. flexor digitorum profundus and inserting on the radial (medial) sides of digits II-V. Occasionally, mm. lumbricales may insert on the ulnar (lateral) side of the digits, as seen in Microchiroptera (Jouffroy, 1971). Mm. lumbricales are all innervated by the median nerve in *Orycteropus* and in *Didelphis* (Brandell, 1965), and the ulnar nerve in *Canis* (Getty, 1975). The innervation is split between median and ulnar in most mammals, for example one member of the pair serving digit III in *Equus* is innervated by the median and the other by the ulnar nerve (Sisson, 1914). In *Microgale* and *Petrodromus*, the lumbrical for digit V is innervated by the ulnar nerve. If more reliable data regarding innervation could be collected, the pattern of distribution of the median and ulnar nerves in the hand could be quite interesting.

In Monotremata, there are three mm. lumbricales in *Ornithorhynchus* and at least four mm. lumbricales in the Tachyglossidae (Mivart, 1866; Coues, 1870; Fewkes, 1878; Allen, 1912; Howell, 1936; Diogo & Abdala, 2010).

There are usually four mm. lumbricales in Marsupialia (Macalister, 1870; Coues, 1872; Cunningham, 1882; MacCormick, 1886; Jones, 1949; Stein, 1981; Linkinhoker, 1997), although sometimes there are fewer, particularly in Diprotodontia (Young, 1882; Sidebotham, 1885; Parsons, 1896b).

Mm. lumbricales are large and fleshy in *Orycteropus* and originate from the palmar surface of the conjoined tendon of m. flexor digitorum profundus, instead of from the spaces between the digital tendons as in *Didelphis* and most other mammals (Humphry, 1868; Galton, 1870; Coues, 1872; Sonntag, 1925). This is very similar to the condition seen in *Potamogale* and other tenrecs (Dobson, 1882a; Verheyen, 1961; Jullien, 1967; Neveu & Gasc, 2002). The macroscelidids show the more typical pattern of four mm. lumbricales between the tendons (Jullien, 1967).

The hyracoids have only two small mm. lumbricales, for digits III and IV (Windle & Parsons, 1901). Every description of mm. lumbricales in *Elephas* gives a different configuration, but the most reliable author says there are three mm. lumbricales serving digits II-IV (Nielsen, 1965). Mm. lumbricales may be absent in Sirenia, though one is described for digit IV (Murie, 1872a).

Within Xenarthra, the digits of insertion are quite variable. In the Pilosa, the muscles are often absent, as in *Bradypus*, or there may be two mm. lumbricales for digits III-IV (Galton, 1869b; Humphry, 1869b; Macalister, 1869a). In the Cingulata, most often there are three mm. lumbricales (Macalister, 1875a; Linkinhoker, 1997).

In Eulipotyphla, the typical pattern of four mm. lumbricales is seen in *Solenodon* and some Erinaceidae, while the muscles are reduced or absent in most Erinaceidae (Dobson, 1881a, 1882b; Parsons, 1898a; Jullien, 1967; Neveu & Gasc, 2002). Mm. lumbricales are absent in Soricidae and Talpidae (Dobson, 1882b, 1883; Haines, 1955; Gugler, 1959; Jullien, 1967; Neveu & Gasc, 2002).

Mm. lumbricales are absent in Chiroptera, although Humphry (1869a) describes something "like lumbricales" in *Pteropus*, serving digits II-III. Mm. lumbricales are also absent in the fossorial marsupial mole *Notoryctes* and in the golden moles, as in talpids (Dobson, 1883; Wilson, 1894; Parsons, 1901; Jullien, 1967).

The four mm. lumbricales are typical in *Manis*, Felidae, Viverridae, Ursidae, Ailuridae, and often in mustelids (Humphry, 1869b; Mivart, 1882; Kelley, 1888; Reighard & Jennings, 1901; Hall, 1926; Davis, 1964; Getty, 1975; Feeney, 1999; Fisher et al., 2009; Julik et al., 2012). However, there are only two mm. lumbricales in *Procyon* (Allen, 1882), and three, for digits III-V, in Canidae (Getty, 1975; Feeney, 1999). *Crocuta* has the typical four mm. lumbricales, but *Hyaena* has only two, for digits III-IV (Watson & Young, 1879; Young & Robinson, 1889; Spoor & Badoux, 1986a). Mm. lumbricales are absent in most pinnipeds, although one was observed for digit II in

Odobenus (Humphry, 1868; Murie, 1872d). Although they are often described as absent in artiodactyls (Windle & Parsons, 1901; Beddard, 1909; Campbell, 1936; Kneepkins et al., 1989), there is one serving digit II in *Sus* (Windle & Parsons, 1901; Sisson, 1914; Cambell, 1936), and remnants of m. lumbrical serving digit IV in ruminants and hippos (Bell, 1876; Windle & Parsons, 1901; Sisson, 1914; Getty, 1975; Fisher et al., 2007). In *Tragulus* the sparse fibers are found in between digits III and IV. Mm. lumbricales are absent in Cetacea (Cooper et al., 2007).

Within Perissodactyla, mm. lumbricales are variable. There are three mm. lumbricales for digits II-IV in *Tapirus* (Murie, 1871; Windle & Parsons, 1901; Campbell, 1936). In *Equus*, the single digit III receives one m. lumbrical on each side (Windle & Parsons, 1901; Sisson, 1914). Mm. lumbricales are absent in *Rhinoceros* (Windle & Parsons, 1901).

Rodentia, Lagomorpha, Scandentia, Dermoptera, and Primates usually have the typical pattern of four mm. lumbricales (Owen, 1866; Champneys, 1871; Murie & Mivart, 1872; Dobson, 1881b; Parsons, 1898b; Primrose, 1899; Bensley, 1921; Woollard, 1925; Le Gros Clark, 1924, 1926; Beattie, 1927; Young, 1937; Patterson, 1942; Wood & White, 1950; Miller, 1952; Rinker, 1954; Haines, 1955; Hill, 1959; Schön, 1968; Woods, 1972; George, 1977; McEvoy, 1982; Soligo, 2005; Standring et al., 2005). In some rodents, however, only the three lateral digits receive mm. lumbricales (Kesner, 1986; Stein, 1986; Bezuidenhout & Evans, 2005).

Rarely do mammals have more than four mm. lumbricales (Galton, 1869a – *Euphractus*; Diogo & Abdala, 2010 - *Cynocephalus*). In such a case the muscle was scored as having four mm. lumbricales.

Summary: Primitively there are four mm. lumbricales, which is the condition in *Orycteropus*, Tenrecidae, Macroscelidea, Marsupialia, Euarchontoglires, *Solenodon*, some Erinaceidae, *Manis*, and many Carnivora. Mm. lumbricales are reduced in Paenungulata, Artiodactyla, Perissodactyla, and Xenarthra. Mm. lumbricales are absent in fossorial Talpidae, Chrysochloridae, and *Notoryctes*, as well as in Chiroptera.

Character 56. M. contrahens – digit I

Absent (0), present (1)

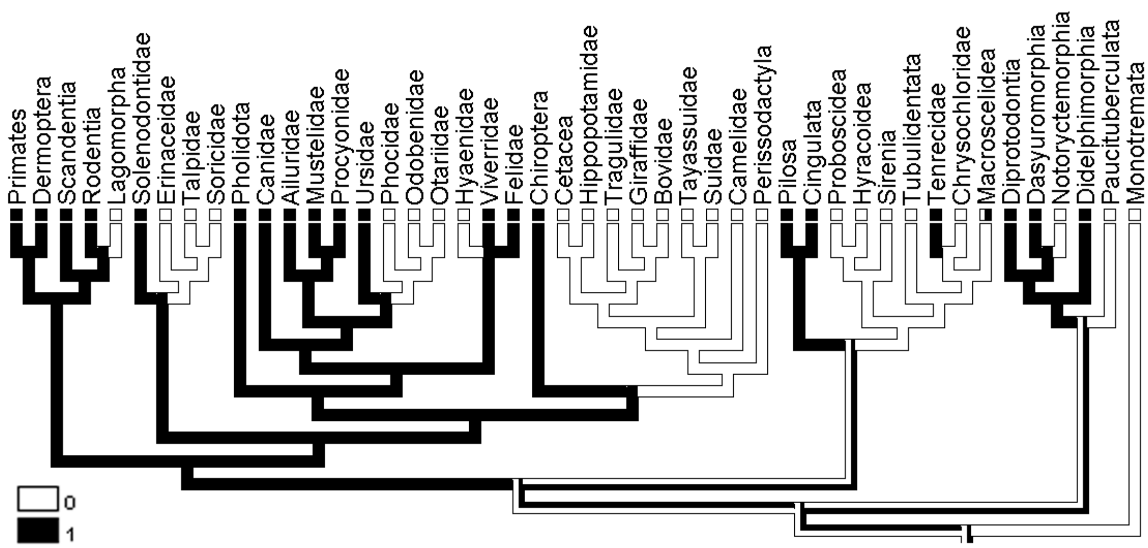

Figure 4.56. Phylogeny depicting presence of m. contrahens – digit I.

Character 57. M. contrahens – digit II

Absent (0), present (1)

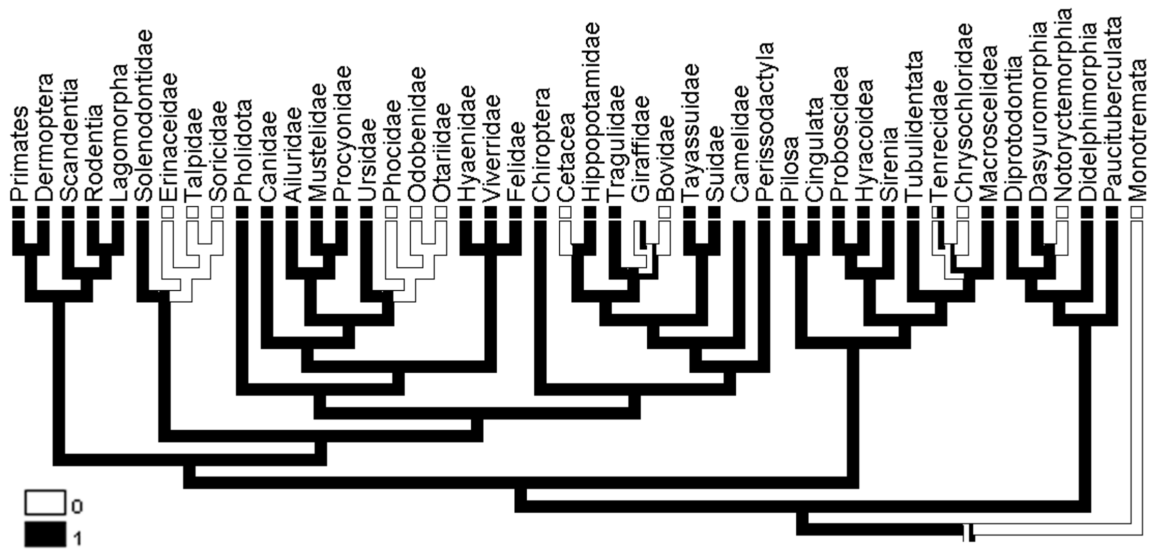

Figure 4.57. Phylogeny depicting presence of m. contrahens – digit II.

Character 58. M. contrahens – digit IV

Absent (0), present (1)

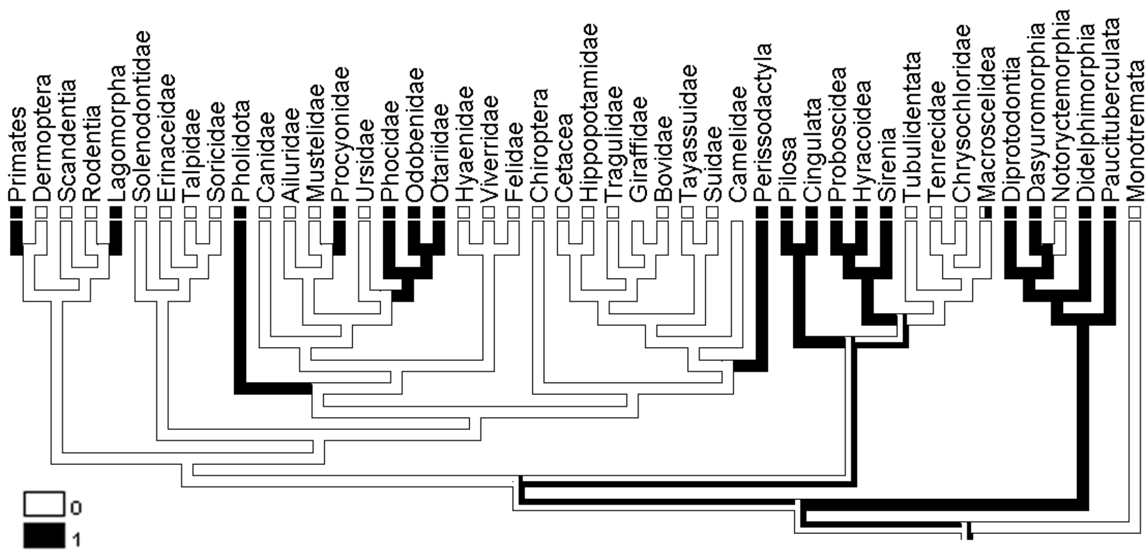

Figure 4.58. Phylogeny depicting presence of m. contrahens – digit IV.

Character 59. M. contrahens – digit V

Absent (0), present (1)

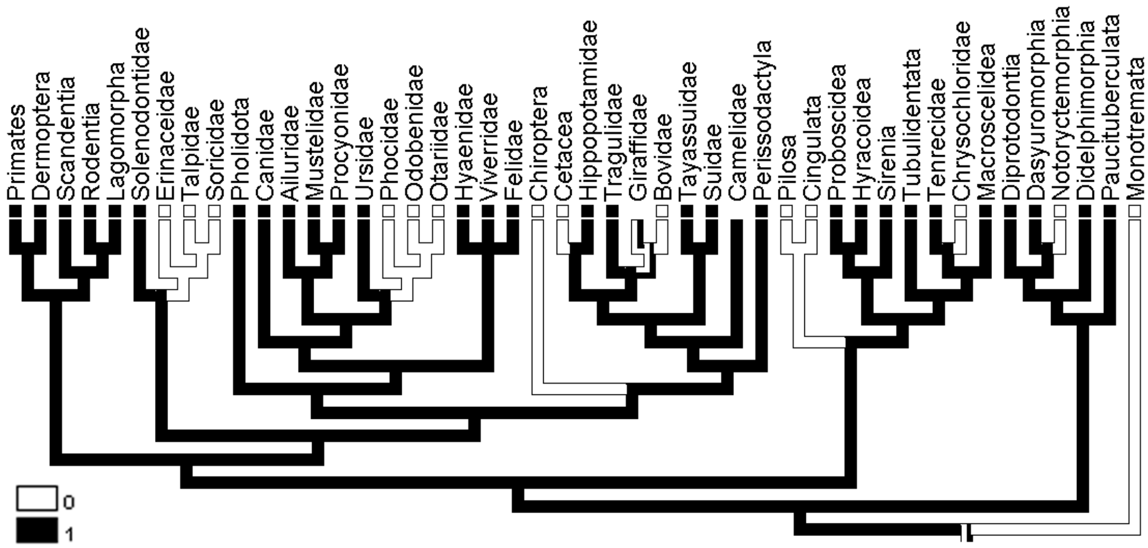

Figure 4.59. Phylogeny depicting presence of m. contrahens – digit V.

Mm. contrahentes, also known as adductores, are found deep to the flexor tendons and superficial to mm. flexor digitorum breves profundus. They are always separated from mm. flexor digitorum breves profundus by the deep branch of the ulnar nerve (Campbell, 1936; Haines, 1955; Jouffroy, 1971). Mm. contrahentes are supplied by the deep branch of the ulnar nerve in the afrotheres I dissected, as well as in *Petrogale* (Parsons, 1896b), *Ptilocercus* (Haines, 1955), artiodactyls (Campbell, 1936), and primates such as *Callimico* (Hill, 1959). The muscles originate from the carpus or base of the metacarpals and act to adduct the four marginal digits toward digit III. M. adductor pollicis of human anatomy represents m. contrahens of the pollex (Yamamoto et al., 1988), but this single m. contrahens is far from standard in Mammalia.

In the Monotremata, whether there are mm. contrahentes is not clear (Diogo & Abdala, 2010). It seems there are muscles present in the fascia over digits II-III-IV-V which might represent mm. contrahentes in Tachyglossidae, but mm. contrahentes are absent in *Ornithorhynchus* except for a possible m. adductor pollicis (Fewkes, 1878; Allen, 1912; Howell, 1936; Diogo & Abdala, 2010).

In Didelphimorphia, Dasyuromorphia, and most Diprotodontia there are four mm. contrahentes, for digits I-II-IV-V (Macalister, 1870; Young, 1880; Cunningham, 1882; MacCormick, 1886; Jones, 1949; Stein, 1981; Linkinhoker, 1997). In *Caenolestes* and *Thylacinus*, m. contrahens for digit I is absent (Osgood, 1921). The fossorial *Notoryctes* lacks mm. contrahentes (Wilson, 1894).

Xenarthrans are quite variable, with *Dasypus* and *Bradypus* having mm. contrahentes for digits I-II-IV (Linkinhoker, 1997). Mm. contrahentes for digits II and IV present in *Euphractus* are described as forming an "X" across the palm (Galton, 1869a), similar to what is seen in *Orycteropus*.

The tenrecoids and the elephant shrews *Elephantulus* and *Petrodromus* have mm. contrahentes for digits I-II-V (Dobson, 1883; Haines, 1955; Verheyen, 1961; Jullien, 1967).

Orycteropus and the artiodactyls, lacking a pollex, have mm. contrahentes for only digits II and V (Galton, 1870; Windle & Parsons, 1901; Sisson, 1914; Sonntag, 1925; Campbell, 1936; Kneepkins et al., 1989; Fisher et al., 2007).

Rhynchocyon, the hyracoids, proboscideans, and *Tapirus* have mm. contrahentes for digits II-IV-V (Campbell, 1936; Miall & Greenwood, 1878a; Windle & Parsons, 1901; Shindo & Mori, 1956a; Jullien, 1967). Sirenia have been described as having mm. contrahentes for either II-IV-V (Murie, 1872a, 1885), similar to the other paenungulates, or III-IV-V (Domning, 1977, 1978), which would be quite aberrant within mammals.

The fossorial chrysochlorids are lacking any mm. contrahentes, though it is possible some tissue I observed in *Calcochloris* or that has been reported in *Eremitalpa* could be the remnants of mm. contrahentes (Gasc et al., 1986).

Cetacea lack mm. contrahentes (Cooper et al., 2007). Eulipotyphlans also lack mm. contrahentes, except *Solenodon*, which has mm. contrahentes for digits I-II-V (Dobson, 1882b).

Chiropterans have only a single m. contrahens for the pollex and possibly a vestigial belly for digit II (Vaughan, 1959; Vaughan & Bateman, 1970; Norberg, 1972; Altenbach, 1979).

Most carnivores have mm. contrahentes for digits I-II-V (Reighard & Jennings, 1901; Hall, 1926; Fisher, 1942; Davis, 1964; Getty, 1975; Feeney, 1999; Fisher et al., 2009; Julik et al., 2012). It is unclear which digits are served in the Hyaenidae, but it appears to be digits II and V (Young & Robinson, 1889; Spoor & Badoux, 1986a). There are occasional references to m. contrahens for digit IV (Murie, 1872d, for pinnipeds; Allen, 1882, for *Procyon;* Kelley, 1888, for *Ursus*), which lends support to the hypothesis that Carnivora primitively had the full complement of mm. contrahentes serving digits I-II-IV-V. *Manis* still has mm. contrahentes for digits I-II-IV-V (Humphry, 1869b).

Some primates supposedly have five mm. contrahentes, one for each digit (Jouffroy, 1962; Schultz, 1984; Soligo, 2005). Many primates retain only mm. contrahentes for digits I-II-V and these are further reduced to the single m. adductor pollicis in *Homo* (Owen, 1866; Murie & Mivart, 1872; Schön, 1968; Soligo, 2005). During human ontogeny, however, there is evidence for four mm. contrahentes, and mm. contrahentes to digits II, IV, and V have been observed in humans with trisomies 13, 18, or 21 (Cihak, 1972; Dunlap et al., 1986; Diogo & Abdala, 2010). According to Soligo (2005: 287), "in the primitive primate (and mammalian) arrangement a contrahens was present for each of the five digits, thus paralleling the arrangement seen in reptiles, where the stratum medium of the flexor brevis medius inserts into all digits of the hand [McMurrich, 1903b]." There does not seem to be evidence for five mm. contrahentes in the other groups of mammals, however.

Scandentia, Rodentia, and Dermoptera have mm. contrahentes for digits I-II-V, although some rodents have only one or two mm. contrahentes and *Bathyergus* has none (Parsons, 1898b; McMurrich, 1903b; Le Gros Clark, 1926; Rinker, 1954; Haines, 1955; George, 1977; Kesner, 1986; Stein, 1986; Diogo & Abdala, 2010). Lagomorpha, however, have mm. contrahentes for digits II-IV-V (Craigie, 1966).

Mm. flexor digitorum breves profundus[25] - Not scored due to inconsistent data

Primitively, mm. flexor digitorum breves profundus (= mm. interossei of human anatomy) should be five two-headed muscles, one inserting on either side of each digit, with a total of ten insertions per hand (Haines, 1955; Diogo et al., 2009; Diogo & Abdala, 2010). They originate from a common fibrous sheet over the carpals and proximal metacarpals in insectivores, macroscelidids, hyracoids, *Orycteropus*, and tenrecoids. They originate directly from the metacarpals in marsupials, carnivores, and primates. Often the muscles insert onto the sesamoids at the metacarpophalangeal joints. While this seems fairly straightforward, the application of a varied terminology, the lack of

[25] flexores digitorum breves, intermediate group, interossei, palmar interossei, short flexors of digits I and V, ventral interossei

accurate illustrations or information about innervation, and the reduction of digits in many mammals make it impossible to determine from the literature the situation of these small deep flexors in most mammals.

Diogo & Wood (2011) discuss the deep musculature of the palm in Primates and determine that the opponens muscles have differentiated from the flexor breves profundus. I am inclined to agree; many situations, however, are ambiguous, such as in *Chlamyphorus*, in which the only described m. flexor brevis profundus is an “opponens pollicis” (Macalister, 1875a; Windle & Parsons, 1899a). Complete descriptions are so sparse that any cladistic analysis based on this very incomplete data would be inaccurate until more complete information can be obtained via dissection. Thus, I will consider the muscles in some taxa briefly, without scoring this feature.

In monotremes, four to ten mm. flexor digitorum breves profundus have been described (Mivart, 1866; Coues, 1870; Fewkes, 1878; Allen, 1912; Howell, 1936).

Marsupials typically have a full set of ten, except for *Notoryctes*, which may have only three short flexors (Young, 1880, 1882; Cunningham, 1882; Sidebotham, 1885; MacCormick, 1886; Wilson, 1894; Osgood, 1921; Jones, 1949; Stein, 1981; Linkinhoker, 1997).

Similarly, afrotherians except chrysochlorids have substantial mm. flexor digitorum breves profundus for each existing digit (Murie & Mivart, 1865; Humphry, 1868; Galton, 1870; Murie, 1872a; Miall & Greenwood, 1878a; Dobson, 1882a, 1883; Windle & Parsons, 1901; Haines, 1955; Shindo & Mori, 1956a; Verheyen, 1961; Nielsen, 1965; Jullien, 1967; Domning, 1978; Thewissen & Badoux, 1986; Neveu & Gasc, 2002). The muscles are quite robust and fleshy in *Orycteropus*, and a considerable flexing power is “localized in the palm, and exercises no influence on the movements of the wrist joint” (Young, 1880: 160). The aardvark and hyracoids have what appears to be an additional flexor digiti brevis profundus on the second digit, acting rather like an “abductor indicis” (Galton, 1870; Sonntag, 1925). This might be a flexor digiti brevis profundus meant for the reduced or absent pollex, or possibly a remnant of an intermetacarpale muscle. A similar muscle is described in *Elephas* and in *Erinaceus*, which have all five digits (Dobson, 1882b; Nielsen, 1965).

Eulipotyphlans except the more fossorial talpids have typical and fleshy mm. flexor digitorum breves profundus (Dobson, 1881a, 1882b, 1883; Parsons, 1898a; Reed, 1951; Haines, 1955; Sharma, 1958; Gugler, 1959; Jullien, 1967; Whidden, 2000; Neveu & Gasc, 2002).

Character 60. Mm. intermetacarpales

Absent (0), present (1)

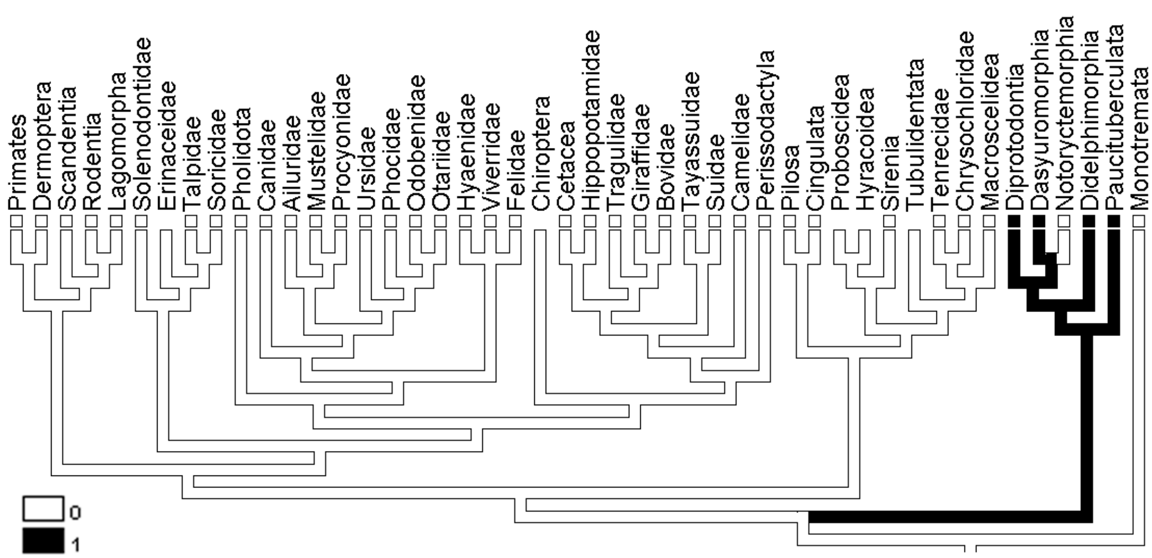

Figure 4.60. Phylogeny depicting presence of mm. intermetacarpales.

Mm. intermetacarpales are not mentioned in the Nomina Anatomica Veterinaria (2005), the Terminologica Anatomica (1998), or the Traité de Zoologie (Jouffroy, 1971). These muscles are an additional layer of deep flexors found between the metacarpals, present in Amphibia and Reptilia (Diogo & Abdala, 2010. They are also present in some mammals, but occurance is difficult to determine from a survey of the literature as the terminology for the intrinsic muscles of the manus has been variably applied.

Mm. intermetacarpales are absent in *Ornithorhynchus* (Howell, 1936; Diogo & Abdala, 2010). There are four mm. intermetacarpales in marsupials, although they are absent in *Notoryctes* (Macalister, 1870; Coues, 1872; Young, 1880, 1882; Cunningham, 1882; Sidebotham, 1885; MacCormick, 1886; Wilson, 1894; Osgood, 1921; Jones, 1949; Stein, 1981). The situation in placental mammals is confused as the terminology for the intrinsic muscles of the manus has been variably applied. Mm. intermetacarpales seem to be absent in most placentals (Parsons, 1898a; Reed, 1951; Gugler, 1959; Linkinhoker, 1997), with the possible exceptions of Chiroptera and Euarchontoglires. Some Chiroptera may have a single "interosseus dorsales," but mm. flexor digitorum breves profundus are reduced so it is difficult to determine if this is correct (Vaughan, 1959; Altenbach, 1979). The "dorsal interossei" of humans and other primates may be the same muscles, or may be differentiated portions of mm. flexor digitorum breves profundus. According to Diogo & Abdala (2010) and Diogo & Wood (2012) there are four intermetacarpales in *Rattus* and primates innervated by the deep branch of the ulnar nerve. As this situation is unclear to me, I have scored intermetacarapales as only present in marsupials. This character scoring, however, deserves review.

Sesamoids in the manus – not scored due to incomplete data

There is a great diversity of fibrous, cartilaginous, and even ossified structures found in addition to the typical bones of the mammalian hand. The most intriguing is the structure called the falciform bone or "pre-pollex," which is found on the radial side of the manus. Whether any sesamoids on the radial side of the manus are homologous throughout Mammalia is unclear.

For example, a sesamoid is found articulating with the scaphoid in *Ptilocercus*, which possesses all five digits (Haines, 1955). The most medial (radial) of the short thumb flexors takes origin from the deep surface of the sesamoid (Salton & Sargis, 2008). A sesamoid is present in *Pongo* and *Alouatta* within the tendon of m. abductor pollicis longus, "wedged between the scaphoid and trapezium" (Primrose, 1899; Schön, 1968: 96). There is a similar cartilaginous sesamoid bone in the distal tendon of m. abductor pollicis longus in *Didelphis* (Young, 1880), canids (Feeney, 1999; Getty, 1975), and *Potamogale*. Windle & Parsons (1901) described this sesamoid in some artiodactyls and believed it was a "vestige of the second metacarpal." This is like the situation seen in aardvarks and hyracoids: what seems to be the small vestigial metacarpal for the pollex is embedded in the distal tendon of m. abductor pollicis longus.

A radial sesamoid can also be associated with m. palmaris longus. In *Suncus*, there is "a small and flat sesamoid bone… on the radial side of the joint between the scapholunar and the trapezium… contained within the medial tendon of the palmaris longus" (Sharma, 1958: 461). Reed (1951) describes a similar sesamoid in *Neurotrichus*, and the medial tendon of palmaris longus inserting on a true falciform in *Scapanus*.

This diversity of sesamoid structures on the radial side of the manus needs further study. I agree with Salton & Sargis (2008) that a long pisiform and pre-pollex correlate with a deeper space for the flexores digitorum and a larger attachment for the flexor retinaculum, as this seems to be the case in *Potamogale*.

In *Elephantulus*, there are three or four small flat cartilaginous plates embedded in the fibrous tissue over the carpals and base of the metacarpals (Haines, 1955). A similar but larger pair of plates is found in the palm of the hyracoids, presumably to facilitate the gliding of the tendons of m. flexor digitorum profundus. In *Calcochloris*, there are large cartilaginous pads over the carpals, presumably to cushion the large sesamoid in the tendon of m. flexor digitorum profundus, the "third bone." In *Manis*, the sesamoid in the tendon of m. flexor digitorum profundus glides over the convex surface of the scapho-lunar (Humphry, 1869b). In rodents, there is a true falciform and some superficial cartilaginous pads in the palm (Kesner, 1986).

Median nerve in the manus – not scored due to incomplete data

Windle & Parsons (1901: 703) cite some unpublished dissections of the elephant, indicating that "the median nerve plays a much larger part than it does in Man and, so far as we know, most other mammals." This is consistent with suggestions made for the innervation of the hyrax manus (Cunningham, 1881), and with my observations of the innervation in the manus of *Orycteropus* and other afrotheres: the median nerve is much larger than the ulnar nerve, often supplies sensory innervation to both sides of digit IV, and innervates mm. lumbricales and flexor digitorum breves manus. In *Rhynchocyon* there is a different situation, as the ulnar nerve actually supplies both sides of digit IV.

Interestingly, in reptiles and amphibians, the median nerve is more important in the forearm and hand than is the smaller ulnar nerve (Straus, 1942; Jouffroy, 1971). In aardvark, as in *Didelphis*, there are “peculiar anastomoses found between the interdigital branches of the median nerve and the deep volar ramus of the ulnar nerve” in the manus (Brandell, 1965: 133). New dissections carefully noting the distribution of the median and ulnar nerves in the manus of a diversity of mammals could provide much information about phylogeny or patterns of digit reduction; however, it is possible that “the median and ulnar nerves are not to be regarded as definite and invariably equivalent nerves, but merely as paths which may conduct elements of different origins” (McMurrich, 1903a: 189).

The above characters are used in parsimony analysis to elucidate mammalian interrelationships, which is discussed in Chapter 5.

Chapter 5 – FORELIMB MYOLOGY AND THE EVOLUTIONARY RELATIONSHIPS OF THE AARDVARK

In this chapter I discuss two phylogenetic analyses of the 60 forelimb myology characters that were discussed and optimized on Waddell & Shelley's (2003) phylogeny in Chapter 4. Appendix 2 contains a summary of each source of data, including my own dissections, referenced to identify the characters. Appendix 3 contains the data matrix. As discussed in Chapter 2, Materials & Methods, the parsimony analyses were performed using the program Mesquite 2.75 (Maddison & Maddison, 2011).

There is much symplesiomorphy in the forelimb myology dataset, although this is not entirely unexpected given the overall similarity in the muscular system of mammals. Despite this, the phylogenetic analyses using the myological dataset were promising, and this kind of analysis could be more informative if characters of the hind limb, head, and neck myology were also included.

The first parsimony analysis of the forelimb myology data matrix includes all of Mammalia, and the second is restricted to only Afrotheria. Several studies have used data from forelimb myology to discuss the phylogeny within a family or order of mammals (Stein, 1986, 1987, 1990, 1993; Ryan, 1989; Whidden, 2000; Gibbs, 2002; Neveu & Gasc, 2002), but few have used only myological data to determine interordinal relationships (Shoshani, 1993; Whidden, 2002). One recent study has used 4,541 skeletal, dental, and myological characters across a wide range of mammals (O'Leary et al., 2013 figure S2A). My analyses are preliminary until better primary myological data can be collected, but evidence that myological data on its own can indicate the phylogeny of a broad group of mammals.

Parsimony analysis 1: Eutherian mammals

The initial parsimony analysis of 60 forelimb myology characters for 46 families or orders representing almost all orders of mammals – Eutheria with Marsupialia and Monotremata outgroups – recovered 178 trees of equal length, 445 steps. The strict consensus tree is uninformative, resulting in a polytomy of all mammalian groups studied here (CI 0.125, RI 0.0). This indicates that no clades are present in all 178 most-parsimonious trees.

However, the 50% majority rules consensus tree (Figure 5.1), which depicts clades found in 50% of the 178 most-parsimonious trees, is not too different from molecular phylogenies (for example, O'Leary et al, 2013 figure S2B). Most mammals, particularly those for which good quality anatomical descriptions are available, are grouped in currently recognized clades by the forelimb myology data. There are a few groups that have aberrant placement, so using only the current 60 characters of forelimb myology results in a 50% majority rules consensus cladogram that appears to partially reflect the currently recognized phylogeny of mammals and partially reflect functional anatomy (Figure 5.1).

This consensus tree originally was not rooted, so it was re-rooted at Monotremata which was in a clade with Marsupialia, Tenrecidae, Macroscelididae, and *Orycteropus*. Marsupials are basal to placentals, except *Notoryctes* which groups with the other fossorial mammals in an "insectivore" clade. The most basal placental mammal is *Orycteropus*, reflecting the many primitive features of its forelimb anatomy.

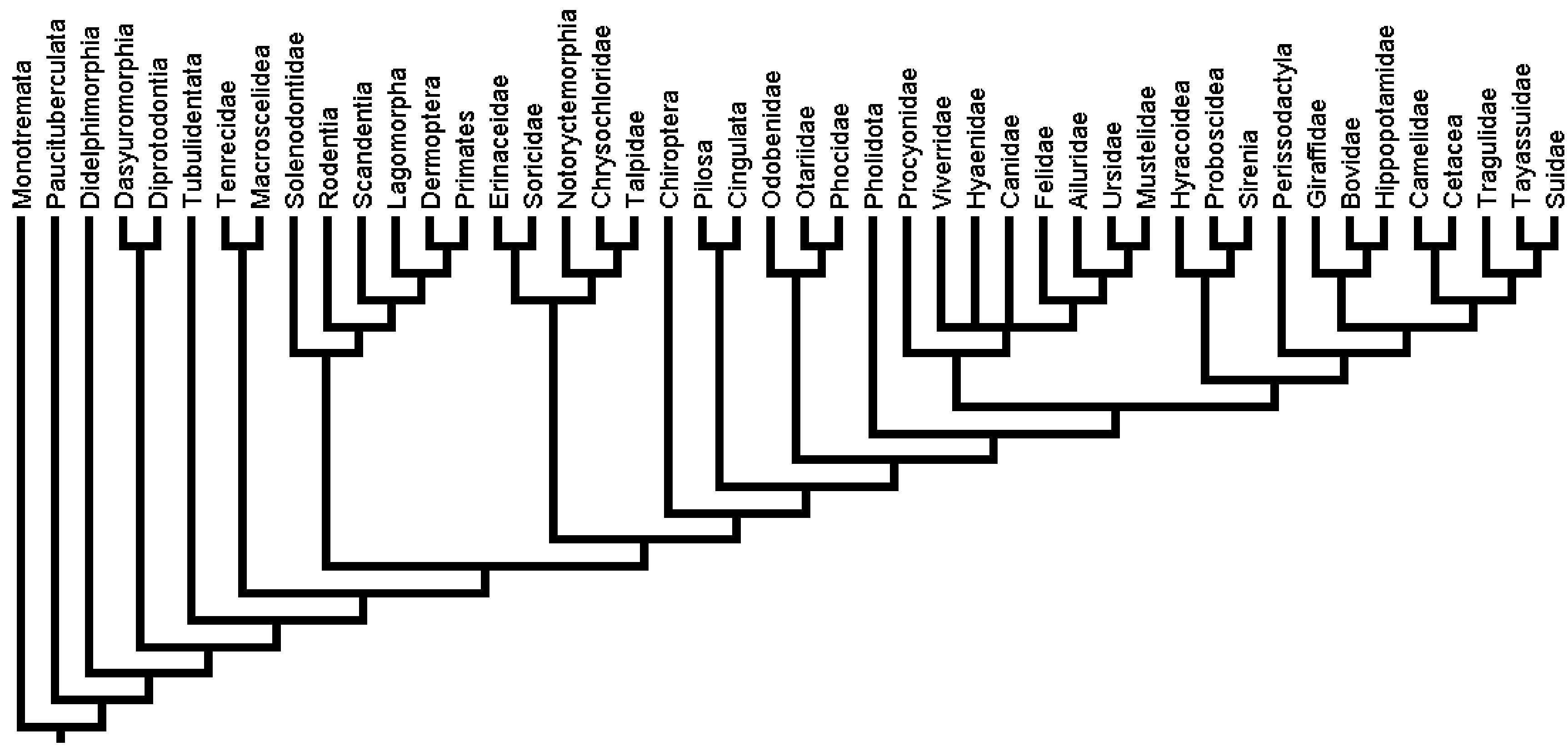

Figure 5.1 Phylogeny of mammals; 50% majority rules consensus tree based on parsimony analysis of 60 characters of forelimb myology (CI 0.2511, RI 0.5740)

Next is a clade formed by Tenrecidae and Macroscelididae; this placement of Tenrecidae provides some morphological support for the Afrotheria hypothesis (Stanhope et al., 1998) but is an unusual result for morphological characters which typically group tenrecs and chrysochlorids with Eulipotyphla (Novacek, 1986; Novacek & Wyss, 1986; Asher et al., 2003; O'Leary et al., 2013). The basal position of three afrothere families in this analysis lends support to the hypothesis that Afrotheria is the most basal clade of placental mammals (Murphy et al., 2001b; Delsuc et al., 2002; Kjer & Honeycutt, 2007; Asher, 2007; Waddell & Shelley, 2003).

Chrysochloridae, which typically lies near Tenrecidae in both morphological and molecular phylogenies, instead forms a "mole" clade with Talpidae and Notoryctemorphia—obviously united by homoplasy— nested within Soricidae and Erinaceidae. The inclusion of Notoryctemorphia seems to indicate that specializations of fossorial locomotion, such as the lack of most intrinsic muscles of the manus, in this case overwhelm any phylogenetic signal in the forelimb myology. That the fossorial morphology, which has evolved independently in these groups, strongly overrides their evolutionary history demonstrates "how morphological convergence can result from similar selection pressures in analogous environments" (Tabuce et al., 2008: 7; see also Madsen et al., 2001). My survey of the forelimb myology thus disagrees with the assessment of Wilson (1894: 5) who stated, "so far as I can judge from my very limited acquaintance with the myology of *Chrysochloris*, the muscles of the anterior limb of that animal are far less like those of *Notoryctes* than at least a superficial comparison of the skeletons would lead one to expect."

Euarchontoglires is recovered as a clade. In the 50% majority rules consensus tree, Solenodontidae groups with Euarchontoglires, but in the 178 trees it sometimes groups with Eulipotyphla, and sometimes is basal to placental mammals. Waddell & Shelley (2003) describe similar difficulties placing *Solenodon* utilizing genetic data.

Xenarthra is recovered, but as part of a mixed grouping of Laurasiatheria and Afrotheria. Typically Xenarthra is considered sister group to Boreoeutheria (Delsuc et al., 2002), or as sister clade to Afrotheria and this Atlantogenata clade is the root of the Eutherian tree (Stanhope et al., 1998; Murphy et al., 2007; Asher et al., 2009; Morgan et al., 2013), or as the most basal clade of placental mammals (Gregory, 1910; McKenna, 1975, 1997; Novacek, 1992; Shoshani & McKenna, 1998; Kriegs et al., 2006; O'Leary et al., 2013).

Paenungulata is recovered, nested between Carnivora and Perissodactyla within the "cursorial" clade. That myological data support Paenungulata is consistent with phylogenies based on skeletal and dental data (Gregory, 1910; Simpson, 1945; Novacek & Wyss, 1986; Shoshani, 1986; Novacek, 1992; Robinson & Seiffert, 2004; Tabuce et al., 2008) and molecular data (de Jong et al., 1981; Stanhope et al., 1998; Springer et al., 1999; Delsuc et al., 2002; Malia et al., 2002; Amrine-Madsen et al., 2003; Murata et al., 2003; Waddell & Shelley, 2003; Nishihara et al., 2005; Kjer & Honeycutt, 2007; Murphy et al., 2007). Recovering Paenungulata as basal to the other ungulates is not unusual for a morphological analysis, as hyracoids and proboscideans are recognized as the "ecomorphological equivalents" of perissodactyls and artiodactyls (Tabuce et al., 2008: 8; see also Gheerbrant et al., 2014). Notably, I find some myological similarities between Paenungulata and Perissodactyla, particularly *Tapirus*, echoing some earlier views regarding their evolutionary relationships (Novacek & Wyss, 1986; Prothero et al., 1988). For example, the incorporation of m. omotransversarius with the trapezius complex in m. brachiocephalicus happens in only in Paenungulata, Perissodactyla, and *Potamogale* (Character 4). However, Shoshani (1993) used myological data to reject grouping Paenungulata with Perissodactyla; it is possible this configuration of m. brachiocephalicus is an adaptation for swimming. The grouping of Paenungulata with the ungulates in the consensus tree shows that myological data, like other anatomical data, may carry a strong functional signal as well as a phylogenetic signal.

Overall, the myological dataset shows promise, although it seems that the current 60 character forelimb myology dataset by itself does not resolve the position of *Orycteropus* within Mammalia. The analysis of O'Leary et al. (2013) included myological characters, but many were missing or inaccurate as no primary dissections were done. The myological data described herein is an important addition to such large morphological datasets. The 50% majority rules consensus tree has similarities with other analyses utilizing many more characters, including O'Leary et al. (2013), and the signals detected in this analysis suggest that with the addition of myological characters of the hind limb, head, and neck, better resolution may be possible. This is especially true of specialized locomotor groups, the flying, aquatic, and fossorial mammals.

Parsimony analysis 2: Afrotheria only

A second parsimony analysis was performed to determine the relationships between only the genera within Afrotheria, including *Orycteropus*, as proposed by Stanhope et al. (1998). A 50% majority rules consensus tree of the 23 trees of length 134 was produced (Figure 5.2).

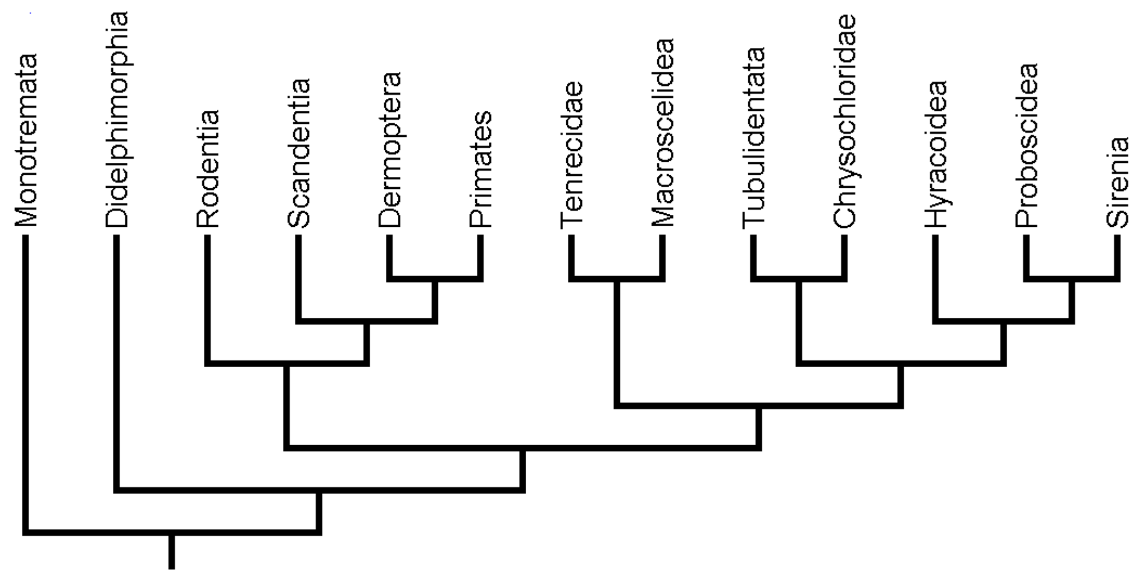

Figure 5.2. Phylogeny of Afrotheria; 50% majority rules consensus tree of 23 most parsimonious trees from parsimony analsysis of 60 characters of forelimb myology (TL 134, CI 0.604, RI 0.619).

Paenungulata is strongly supported by many synapomorphies in both consensus trees (Figures 5.1 and 5.2). Table 3 summarizes the clear similarities in the forelimb myology of Hyracoidae, Proboscidea, and Sirenia. The clade Paenungulata is thus well supported by all sources of data (Robinson et al., 2004; Tabuce et al., 2008; Asher & Seiffert, 2010; O'Leary et al., 2013). As discussed earlier, there are similarities between

Paenungulata and Artiodactyla and Perissodactyla, but there are also similarities with *Orycteropus* and the other afrotheres.

Character	State	Description	Occurance
1 - SM	2	m. sternomastoideus has a strong attachment to the mandible or zygomatic	Mandible in Hyracoidea and Proboscidea, and zygomatic in Sirenia; also weakly attached to mandible in a few Artiodactyla.
2 - CM	2	m. cleidomastoideus inserts on manubrium	Paenungulata, Tenrecidae, and Macroscelididae.
4 - BC	4	m. brachiocephalicus is comprised of mm. clavotrapezius + omotransversarius / clavodeltoideus	The configuration of m. brachiocephalicus seen in Paenungultata also occurs in *Potamogale*, although the elements of the trapezius complex are aberrant and thus homologies are not certain in that taxon; a similar configuration (state 5, in which m. brachiocephalicus also includes m. cleidomastoideus) occurs in Perissodactyla.
6 - AT	2	m. acromiotrapezius inserts on acromion and spine of scapula	*Orycteropus* , Chrysochloridae, Tenrecidae, Macroscelididae, Proboscidea, Sirenia, Erinaceidae, *Solenodon, Caenolestes,* and Euarchontoglires.
13 - OT	2	two portions of m. omotransversarius	Monotremata, Marsupialia, Paenungulata, Chrysochloridae, and in some Euarchontoglires. This character directly conflicts with a character used by O'Leary et al. (2013) who consider the absence of "omocervicalis" (=omotransversarius) a synapomorphy for Paenungulata.
15 - AD	3	m. acromiodeltoideus fused with m. spinodeltoideus at origin	Paenungulata, some Marsupialia.
21 - LD	1	m. latissimus dorsi has dual insertion, i.e. presence of Achselbogen muscle	*Orycteropus,* Tenrecidae, Paenungulata, Carnivora, some Euarchontoglires, Pilosa.
24 - SU	0	m. subclavius absent	Paenungulata, Tenrecidae, Artiodactyla, Perissodactyla, and Carnivora.
27 - BB	5	m. biceps brachii originates glenoid and inserts radius	*Orycteropus,* Chrysochloridae, *Microgale, Elephas,* and *Trichechus,* Talpidae, and some Artiodactyla and Carnivora.
34 - BR	2	m. brachioradialis inserts on carpus	*Orycteropus,* Proboscidea, Sirenia, Marsupialia.
38 - P	0	m. supinator absent or reduced	Paenungulata, Artiodactyla, Cetacea, Perissodactyla, and Lagomorpha. Also used by O'Leary et al. (2013) to diagnose Paenungulata.
39 - EDP	0	m. extensor digitorum profundus absent	Contrary to O'Leary et al. (2013), the absence of m. extensor digitorum profundus ("extensor indicis") should not be used as a synapomorphy for all Paenungulata, but rather only for Hyracoidea. Hyracoidea shares this feature with some Artiodactyla, Cetacea, and Perissodactyla.
48 - E-A	0	m. epitrochleo-anconeus absent	Paenungulata, Artiodactyla, Cetacea, Perissodactyla, Chiroptera, and some Carnivora.
49 - PQ	0	m. pronator quadratus absent or vestigial	Paenungulata, Chrysochloridae, Cingulata, *Solenodon,* Talpidae, Artiodactyla, Cetacea, Perissodactyla, *Manis,* Dermoptera, *Caenolestes,* and Monotremata. Also used by O'Leary et al. (2013) to diagnose Paenungulata.
55 - L	1	mm. lumbricales reduced	Paenungulata, Xenarthra, Artiodactyla, Canidae.
58 - C4	1	m. contrahens for digit IV present	Within Afrotheria, only Paenungulata and Rhynchocyon retain m. contrahens for digit IV. This muscle is also found in Manis, Perissodactyla, Primates, Xenarthra, and Marsupialia.

Table 3. Similarities in the forelimb myology of Paenungulata.

In both the 50% majority rules consensus trees (Figures 5.1 and 5.2), Tenrecidae and Macroscelididae form a clade. A Tenrecidae-Macroscelididae clade is an unusual result for morphological characters. Table 4 lists the synapomorphies and symplesiomorphies that support the clade. There is no myological support for Anagalida (Macroscelidea, Lagomorpha, and Rodentia). There is some myological support for traditional Lipotyphla as listed in Table 5, particularly some characters of the trapezius complex, but there are some striking differences in the myology of the manus.

Character	State	Description	Occurance
2 - CM	2	m. cleidomastoideus inserts on the manubrium	Paenungulata, Tenrecidae, and Macroscelididae have the unusual feature of m. cleidomastoideus inserting on the manubrium (though the character is uncertain in *Tenrec, Elephantulus,* and *Rhynchocyon*).
3 - CT	2	m. clavotrapezius unusual conformation	*Orycteropus, Potamogale, Rhynchocyon,* Cetacea.
6 - AT	2	m. acromiotrapezius inserts on acromion and spine of scapula	*Orycteropus* , Chrysochloridae, Tenrecidae, Macroscelididae, Proboscidea, Sirenia, Erinaceidae, *Solenodon, Caenolestes,* and Euarchontoglires.
8 - ST	3	m. spinotrapezius is separated from m. acromiotrapezius by a large space	Tenrecidae, Macroscelididae, Chrysochloridae, Eulipotyphla, *Caenolestes, Notoryctes* , Monotremata.
9 - DC	1	m. dorsocutaneous is present	Tenrecidae, Macroscelididae, Eulipotyphla, Rodentia, Chiroptera, Marsupialia, and Monotremata.
28 - B	1	m. brachialis inserts on ulna	Afrotheria except Sirenia, Xenarthra, Talpidae, Euarchontoglires, Pholidota, Carnivora, Marsupialia, Monotremata.
32 - TLO	1	m. triceps brachii caput longum has two heads of origin	M. triceps brachii caput longum was clearly separated into two portions in many of the specimens I dissected (*Orycteropus,* Tenrecidae, Chrysochlordidae, Macroscelididae, and Hyracoidea). This feature is not often well described in the literature, and deserves further study. Other mammals that also have two heads of triceps brachii caput longum include Cingulata and some Laurasiatheria.
34 - BR	0	m. brachioradialis is absent	Tenrecidae, Macroscelididae, Chrysochloridae, Hyracoidea, Cingulata, Eulipotyphla, Artiodactyla, some Euarchontoglires, *Notoryctes*.
44 - X	1	mm. interflexorii are present	Tenrecidae, Macroscelididae, Hyracoidea, Euarchontoglires, and a few Artiodactyla and Carnivora.
49 - PQ	1	m. pronator quadratus is present	*Orycteropus,* Tenrecidae, Macroscelididae, Pilosa, Soricidae, Erinaceidae, Carnivora, Euarchontoglires, and Marsupialia.
50 - PB	1	m. palmaris brevis is present	Tenrecidae, Macroscelididae, Proboscidea, Erinaceidae, some Carnivora, Euarchontoglires, and some Marsupialia.
55 - FBM5	1	m. flexor digiti brevis manus for digit V is present	Tenrecidae, Macroscelididae, Paenungulata, many Euarchontoglires, some Lipotyphla, Carnivora, and Perissodactyla.
56 - C1	1	m. contrahens for digit I is present	Tenrecidae, Macroscelididae except *Rhynchocyon,* Xenarthra, Euarchontoglires, *Solenodon,* Carnivora, Chiroptera, and many Marsupialia.

Table 4. Similarities in the forelimb myology of Tenrecidae and Macroscelididae.

Character	State	Description	Occurance
6 - AT	2	m. acromiotrapezius inserts on acromion and spine of scapula	*Orycteropus,* Chrysochloridae, Tenrecidae, Macroscelididae, Proboscidea, Sirenia, Erinaceidae, *Solenodon, Caenolestes,* and Euarchontoglires. This contrasts with Soricidae and Talpidae in which m. acromiotrapezius inserts only on the metacromion.
7 - AT	1	m. acromiotrapezius bifid	Marsupialia, Macroscelididae, Chrysochloridae, Soricidae, Talpidae.
8 - ST	3	m. spinotrapezius is separated from m. acromiotrapezius by a large space	Tenrecidae, Macroscelididae, Chrysochloridae, Eulipotyphla, *Caenolestes, Notoryctes,* Monotremata.
9 - DC	1	m. dorsocutaneous is present	Tenrecidae, Macroscelididae, Eulipotyphla, Rodentia, Chiroptera, Marsupialia, and Monotremata.
14 - OH	1	m. omohyoideus is present	Tenrecidae, Soricidae, Erinaceidae, some Carnivora, Perissodactyla, Euarchontoglires, Marsupialia, Monotremata.
55 - L	0	mm. lumbricales absent	Chrysochloridae, many Eulipotyphla, Chiroptera, some Artiodactyla, Cetacea, *Notoryctes.* This contrasts with mm. lumbricales found in Tenrecidae and Macroscelididae.
56-59 - C	0	mm. contrahentes absent	No mm. contrahentes in Eulipotyphla except for digit V in *Solenodon*; none in Chrysochloridae, *Notoryctes*, Monotremata, Cetacea, some Artiodactyla. This contrasts with mm. contrahentes found in Tenrecidae and Macroscelididae.

Table 5. Similarities in the forelimb myology of families of traditional Lipotyphla.

In the afrothere only 50% majority rules consensus tree (Figure 5.2), Tubulidentata is the sister group of Chrysochloridae. This sister group relationship is recovered in some other phylogenetic analyses based on molecular data (Kjer & Honeycutt, 2007; Murphy et al., 2007), and supported by a feature of the internal carotid artery (Asher, 2001), but this is not a common result (Asher & Seiffert, 2010). Rather, in many recent phylogenies, Tenrecidae and Chrysochloridae are united in Afrosoricida (Stanhope et al., 1998; Springer et al., 1999; Madsen et al., 2001; Murphy et al., 2001a, 2001b; Delsuc et al., 2002; Amrine-Madsen et al., 2003; Asher et al., 2003; Waddell & Shelley, 2003; Seiffert, 2003, 2007; O'Leary et al., 2013). However, the "relationship between tenrecs and golden moles is distant enough that the two have not consistently been recovered as sister taxa in molecular phylogenetic analyses" (Seiffert, 2010: 611; see for example Malia et al., 2002). The "fossorial" clade resulting from the first analysis of all mammals (Figure 5.1) suggests a functional signal in the myology, so it seems wise to discuss together the myological features shared by *Orycteropus* and both Tenrecidae and Chrysochloridae. The similarities, some of them unusual and some symplesiomorphies, uniting *Orycteropus* with Afrosoricida are listed in Table 6. While *Orycteropus* shares some myological similarities with the Paenungulata, it does not share many with Artiodactyla.

In addition to the characters noted Table 6, *Orycteropus* and *Potamogale* are linked by several intriguing similarities which were not scored for the analysis due to insufficient data. Mm. lumbricales have an extensive origin from the palmar surface of the tendon of m. flexor digitorum profundus rather than between the tendons in both genera. Both *Orycteropus* and *Potamogale* have m. palmaris longus emerging from the center of m. flexor digitorum profundus in the same unusual manner. Both genera have a similarly large median nerve compared with the ulnar nerve within the manus. Also, both genera have a trapezius complex with similarly aberrant components that are difficult to homologize with the muscles of the trapezius complex seen in other mammals. The similarities between *Orycteropus* and *Potamogale* are especially interesting given the basal position of the African mainland-dwelling Potamogalinae within the typically Malagasy Tenrecidae (Asher, 2010). In addition, the subfossil *Plesiorycteropus* from Madagascar, long thought to be a tubulidentate (Lamberton, 1946; MacInnes, 1956; Lavocat, 1958; Patterson, 1975, 1978; Thewissen, 1985; Asher et al., 2003), has been identified as a tenrec using ancient DNA (Buckley, 2013).

These additional considerations together with the forelimb myology provide good evidence for including *Orycteropus* in a clade with Afrosoricida and Macroscelididae (=Afroinsectiphilia, Waddell et al., 2001). The "monophyly of aardvarks and Afrosoricida, with elephant shrews as their sister group... was a phylogenetic issue that morphological cladistics has failed to resolve, probably because of their extreme morphological diversification" (Nishihara et al., 2005: 1827).

Character	State	Description	Occurance
2 - CM	1	m. cleidomastoideus inserts on clavicle	Paenungulata, Tenrecidae, and Macroscelididae have the unusual feature of m. cleidomastoideus inserting on the manubrium (though the character is uncertain in *Tenrec, Elephantulus,* and *Rhynchocyon*), whereas the muscle has the typical insertion on the clavicle in *Orcyteropus* and Chrysochloridae.
3 - CT	2	m. clavotrapezius unusual conformation	*Orycteropus, Potamogale, Rhynchocyon,* Cetacea.
6 - AT	2	m. acromiotrapezius inserts on acromion and spine of scapula	*Orycteropus* , Chrysochloridae, Tenrecidae, Macroscelididae, Proboscidea, Sirenia, Erinaceidae, *Solenodon, Caenolestes,* and Euarchontoglires.
11 - RC	1	m. rhomboideus cervicis occipital origin	*Orycteropus*, Chrysochloridae, *Solenodon,* Ursidae, *Caenolestes.*
13 - OT	1	single portion of m. omotransversarius	*Orycteropus,* Tenrecidae, Macroscelididae, Laurasiatheria, and some Euarchontoglires have one m. omotransversarius, whereas Chrysochloridae, Paenungulata, Marsupialia, and other Euarchontoglires have two portions of m. omotransversarius.
21 - LD	0/1	m. latissimus dorsi is fully (0) or partially (1) duplicated	Afrotheria except Macroscelididae, also in some Xenarthra, some Euarchontoglires, Carnivora, and Monotremata.
22 - PC	0	m. panniculus carnosus is large and has a bony attachment	*Orycteropus,* Chrysochloridae, Tenrecidae, *Rhynchocyon,* Proboscidea, Sirenia, Eulipotyphla, Perissodactyla, some Euarchontoglires, most Marsupialia, Monotremata.
25 - S-S	1	m. sternoscapularis originates on sternum or ribs	*Orycteropus,* Chrysochloridae, Tenrecidae, *Rhynchocyon,* Hyracoidea, Cingulata, Talpidae, Artiodactyla, Perissodactyla, Monotremata.
27 - BB	5	m. biceps brachii originates glenoid and inserts radius	*Orycteropus,* Chrysochloridae, *Microgale, Elephas,* and *Trichechus,* Talpidae, and some Artiodactyla and Carnivora.
28 - B	1	m. brachialis inserts on ulna	Afrotheria except Sirenia, Xenarthra, Talpidae, Euarchontoglires, Pholidota, Carnivora, Marsupialia, Monotremata.
31 - D-E	2	m. dorso-epitrochlearis has scapula origin	*Orycteropus,* Chrysochloridae, *Elephas,* Perissodactyla, and possibly Cingulata.
32 - TLO	1	m. triceps brachii caput longum has two heads of origin	M. triceps brachii caput longum was clearly separated into two portions in many of the specimens I dissected (*Orycteropus,* Tenrecidae, Chrysochlordidae, Macroscelididae, and Hyracoidea). This feature is not often well described in the literature, and deserves further study. Other mammals that also have two heads of triceps brachii caput longum include Cingulata and some Laurasiatheria.
35 - ECR	2	m. extensor carpi radialis has one origin and two insertions	*Orycteropus,* Tenrecidae, Paenungulata, Xenarthra, Eulipoptyphla.
41 - PT	2	m. pronator teres is enlarged	*Orycteropus,* Chrysochloridae, Xenarthra, Talpidae, and Pholidota.
42 - PL	1	m. palmaris longus origin includes flexors or olecranon in addition to medial epicondyle	A robust m. palmaris longus is seen in many afrotheres, but particularly noted for *Orycteropus* and Chrysochloridae, and in *Potamogale* m. palmaris longus emerges from the center of the superficial epicondylar head of m. flexor digitorum profundus in an unusual manner identical to that observed in *Orycteropus.* The muscle origin includes the flexors or olecranon in *Orycteropus,* Tenrecidae, Macroscelididae, Marsupialia, and a few families in Laurasiatheria.
46 - FDPr	1	radial head of m. flexor digitorum profundus present	Found in most mammals including *Orycteropus, Potamogale,* and *Tenrec* but is absent in the other afrotheres.
47 - FCU	1	m. flexor carpi ulnaris origin only from ulna	*Orycteropus,* Chrysochloridae, *Potamogale,* and Cetacea.
58 - C4		m. contrahens for digit IV absent	*Orycteropus,* Tenrecidae, Macroscelididae except *Rhynchocyon*, and Chrysochloridae which retain no contrahentes at all, as well as most of Laurasiatheria.

Table 6. Similarities in the forelimb myology of *Orcteropus* and Afrosoricida.

Thus, the myological data provide morphological support and complement the strong molecular data indicating the monophyly of Afroinsectiphilia: concatenated nuclear sequences (Murphy et al., 2001b), complete mtDNA (Murata et al., 2003; Kjer & Honeycutt, 2007), chromosome painting analysis (Robinson et al., 2004), and retroposon insertions (Nishihara et al., 2005; Murphy et al., 2007). Several such published phylogenies of Afrotheria based on molecular or combined molecular and morphological data are depicted in Figure 5.3, with consistency and retention indices for each phylogeny calculated for the current forelimb myology dataset. If *Orycteropus* is a member of Afrotheria, the molecular phylogeny best supported by the dataset of forelimb myology characters is Kjer & Honeycutt (2007), which also shows that the clade Afrotheria is divided into Paenungulata and Afroinsectiphilia and with Tubulidentata as sister group to Chrysochloridae.

Asher & Seiffert (2010: 914) state that "if the paenungulate-Afroinsectiphilian dichotomy is accurate, then macroscelideans comprise an interesting morphological intermediate between the two groups." Such an intermediate status is supported by some phylogenetic analyses (Waddell & Shelley, 2003; Nishihara et al., 2005; Kjer & Honeycutt, 2007), as well as by some of the myological characters. The macroscelidids have myological affinities with Paenungulata and also with Afrosoricida, yet the extremely unusual and primitive retention of two independent heads of m. biceps brachii seems to indicate an ancient origin for this order of mammals. *Rhynchocyon* in particular seems intermediate; it is the only non-paenungulate afrothere to retain m. contrahens for digit IV, lacks m. flexor digiti brevis manus for digit V as do *Orycteropus*, Chrysochloridae, and *Micropotamogale*, and is the only macroscelidid to retain m.

sternoscapularis. More elephant shrews should be dissected to verify these features, especially a specimen of the largest species, Rovero et al.'s (2008) recently discovered *Rhynchocyon udzungwensis*.

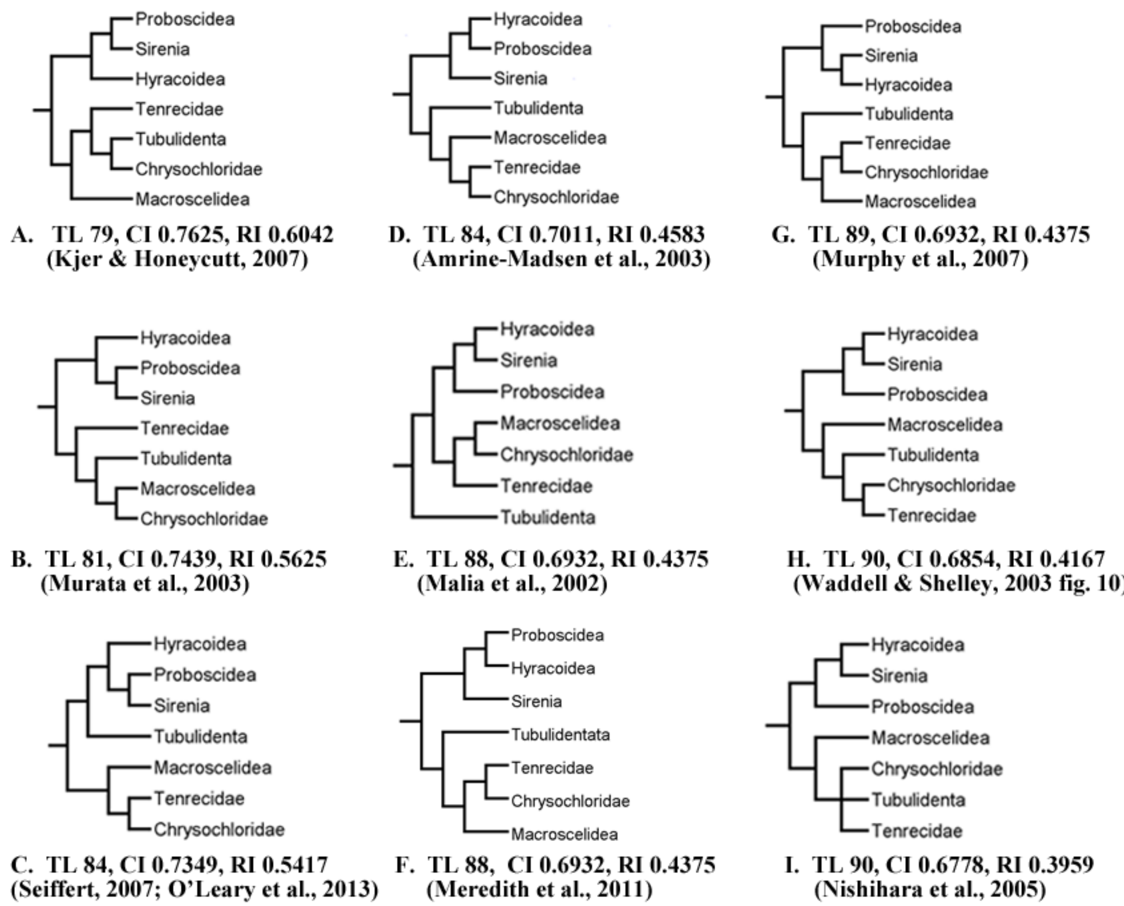

Figure 5.3. Various published phylogenies of Afrotheria.

Tree-length, consistency and retention indices are for the current forelimb myology dataset, indicating that phylogeny A (Kjer & Honeycutt, 2007) is the phylogeny of Afrotheria best supported by the forelimb myology.

Character	State	Description	Occurance
2 - CM	2	m. cleidomastoideus inserts on manubrium	Paenungulata, Tenrecidae, and Macroscelididae have the unusual feature of m. cleidomastoideus inserting on the manubrium (though the character is uncertain in *Tenrec, Elephantulus,* and *Rhynchocyon*), whereas the muscle has the typical insertion on the clavicle in *Orcyteropus* and Chrysochloridae.
6 - AT	2	m. acromiotrapezius inserts on acromion and spine of scapula	Afrotheria except Hyracoidea, also Erinaceidae, *Solenodon, Caenolestes,* and Euarchontoglires.
14 - OH	0	m. omohyoideus is absent	Afrotheria except Tenrecidae, also absent in Xenarthra, *Soleondon,* Talpidae, Pholidota, Carnivora, Chiroptera, and Dermoptera.
21 - LD	0/1	m. latissimus dorsi is fully (0) or partially (1) duplicated	Afrotheria except Macroscelididae, also in some Xenarthra, some Euarchontoglires, Carnivora, and Monotremata.
22 - PC	0	m. panniculus carnosus is large and has a bony attachment	*Orycteropus,* Chrysochloridae, Tenrecidae, *Rhynchocyon,* Proboscidea, Sirenia, Eulipotyphla, Perissodactyla, some Euarchontoglires, most Marsupialia, Monotremata.
25 - S-S	1	m. sternoscapularis originates on sternum or ribs	*Orycteropus,* Chrysochloridae, Tenrecidae, *Rhynchocyon,* Hyracoidea, Cingulata, Talpidae, Artiodactyla, Perissodactyla, and Monotremata.
28 - B	1	m. brachialis inserts on ulna	Afrotheria except Sirenia, Xenarthra, Talpidae, Euarchontoglires, Pholidota, Carnivora, Marsupialia, Monotremata.
29 - +	1	m. cubitalis - additional muscle in cranial arm	I clearly observed m. cubitalis in Hyracoidea, *Potamogale, Microgale,* and *Calcochloris.* I noticed its presence in one elephant shrew (*Rhynchocyon* ?) but did not realize the importance of the extremely small slip of muscle at the time of dissection and thus recorded no data. M. cubitalis may represent a vestigial m. brachioradialis, which is absent in these groups. However, m. cubitalis may be present as the "check ligament" described in Sirenia and Proboscidea (Miall & Greenwood, 1878a; Domning, 1978), which do possess m. brachioradialis. This character has the potential to be a synapomorphy for Afrotheria and needs to be thoroughly investigated.
31 - D-E	2	m. dorso-epitrochlearis does not originate from latissimus dorsi	Afrotheria except Sirenia and Tenrecidae. Alternative origins of m. dorso-epitrochlearis also occur in Monotremata, Cingulata, *Solenodon,* and some Euarchontoglires, some Artiodactyla, some Perissodactyla, and some Carnivora.
32 - TLO	1	m. triceps brachii caput longum has two heads of origin	M. triceps brachii caput longum was clearly separated into two portions in many of the specimens I dissected (*Orycteropus,* Tenrecidae, Chrysochlordidae, Macroscelididae, and Hyracoidea). This feature is not often well described in the literature, and deserves further study. Other mammals that also have two heads of triceps brachii caput longum - possibly not homologous - include Cingulata and some Laurasiatheria.
34 - BR	2	m. brachioradialis inserts on the carpus	*Orycteropus,* Proboscidea, Sirenia, and Marsupialia. (m. brachioradialis is absent in other afrotheres)
43 - FDS	1	m. flexor digitorum superificialis originates from m. flexor digitorum profundus	*Orycteropus,* Hyracoidea, Sirenia, some Tenrecidae, Pilosa, Pholidota, Carnivora, Marsupialia, and Monotremata.
44 - X	1	mm. interflexorii present	Although not noted in all afrothere specimens dissected, connections between the flexor digitorum muscles may be under reported. These are also observed in Primates, Scandentia, Felidae, and Artiodactyla.
46 - FDPr	0	radial head of m. flexor digitorum profundus absent	Absent in Afrotheria except *Orycteropus, Potamogale,* and *Tenrec.* The only other groups lacking this origin of m. flexor digitorum profundus are Hyaenidae, Otariidae, and Monotremata.
51-53 FBM	1	mm. flexor digitorum breves manus present digits I, II, and/or IV	Large and extensive mm. flexor digitorum breves manus innervated by the median nerve are present in Hyracoidea, Tenrecidae, *Elephas,* and Macroscelidinae. The muscles are lacking in Chrysochloridae, *Orycteropus,* and Sirenia. Xenarthra, Hippopotamidae, Felidae, and Pinnipedia are the only other groups possessing mm. flexor digitorum breves for digits I, II, and/or IV (though m. flexor digiti brevis for digit V is widely present within Eutheria).

Table 7. Similarities of the forelimb myology within Afrotheria.

Finally, based on the dissections presented herein, and a review of the literature, there are several possible synapomorphies for Afrotheria summarized in Table 7. All of these features deserve additional investigation, particularly the unusual small muscle here named m. cubitalis and mm. flexor digitorum breves manus. Better myological data from all orders of mammals might more strongly resolve the position of *Orycteropus* within Mammalia, and provide additional support for its inclusion in Afroinsectiphilia and Afrotheria. With additional myological data, the entire Afrotheria clade might be recovered, as there are many myological similarities shared by the orders in this otherwise morphologically disparate grouping of mammals.

Summary

Based on my dissections and the character states reviewed in this dissertation, I find that the forelimb myology of *Orcyteropus* is most similar to that of the Afrosoricida, with Macroscelididae as the sister clade to this grouping (=Afroinsectiphilia, Waddell et al., 2001). There are also several intriguing features of forelimb myology identified here that may provide morphological support for Afrotheria. My results indicate that myological data has been underutilized in phylogenetic analysis, particularly large-scale analysis of mammalian interrelationships. More reliable and detailed information on the myology of a wide variety of mammals would strengthen morphological character datasets. Relying on the literature, as in O’Leary et al. (2013), is not sufficient; primary dissections are needed as muscle identifications are frequently an issue. Future dissections should focus particularly on the muscles of the hyoid and the hind limb, as well as further study of the muscles of the trapezius complex and the cutaneous musculature.

Chapter 6 – SUMMARY AND CONCLUSIONS

As discussed in Chapter 1, a variety of morphological evidence, particularly comparisons with Condylarthra, extinct primitive ungulates, places the aardvark, *Orycteropus afer*, as a basal ungulate (Lönnberg, 1906; Gregory, 1910; Sonntag, 1925; Le Gros Clark & Sonntag, 1926; Matthew, 1937; Simpson, 1945; Kingdon, 1974; Patterson, 1975, 1978; de Jong et al., 1981; Novacek, 1982; Anderson & Jones, 1984; Miyamoto & Goodman, 1986; Shoshani, 1986; Prothero et al., 1988; McKenna, 1975; McKenna & Bell, 1997; Shoshani & McKenna, 1998). In contrast, genetic analyses strongly support the inclusion of Tubulidentata in the superorder Afrotheria along with other basal ungulates-- Proboscidea, Hyracoidea, and Sirenia-- and some insectivorous groups, Macroscelidea, Chrysochloridae, and Tenrecidae (Stanhope et al., 1998; Springer et al., 1999; Madsen et al., 2001; Murphy et al., 2001a, 2001b; van Dijk et al., 2001; Delsuc et al., 2002; Malia et al., 2002; Scally et al., 2002; Amrine-Madsen et al., 2003; Waddell & Shelley, 2003; Springer et al., 2005; Kjer & Honeycutt, 2007; Murphy et al., 2007; Wildman et al., 2007; Meredith et al., 2011). This diverse grouping of mammals has little morphological support (Rose, 2006), although recent research has focused on identifying potential morphological synapomorphies for Afrotheria (Werdelin & Nilsonne, 1999; Seiffert, 2003; Carter et al., 2004, 2006; Zack et al., 2005; Sánchez-Villagra et al., 2007; Seiffert, 2007; Tabuce et al., 2007; Asher & Lehmann, 2008; Asher & Olbricht, 2009; Asher & Seiffert, 2010).

This dissertation uses primary dissection data to identify myological characters to test the conflicting phylogenetic hypotheses of the relationships of *Orycteropus* generated by morphological and molecular data. For the first time, the forelimb myology of *Orycteropus* has been compared directly with that of both ungulates and small afrotherian insectivores, and new data based on these dissections was combined with published myological data to generate new phylogenetic analyses. The dissected mammals were *Orycteropus afer* (Tubulidentata); *Potamogale velox, Microgale dobsoni, Calcochloris leucorhinus* (Afrosoricida); *Rhynchocyon cirnei, Elephantulus brachyrhynchus, Petrodromus tetradactylus* (Macroscelidea); *Procavia capensis, Heterohyrax brucei* (Hyracoidea); and *Pecari tajacu,* and *Tragulus napu* (Artiodactyla). Specimen information is listed in Table 1. The forelimb myology of *Calcochloris* has not been described before, and there is limited anatomical information available for all the dissected genera.

The use of myological data for intraordinal phylogenetic analysis is not new (Stein, 1986, 1987, 1990, 1993; Ryan, 1989; Whidden, 2000; Gibbs, 2002; Neveu & Gasc, 2002; Diogo & Wood, 2011; O'Leary et al., 2013), but it has rarely been used to determine interordinal relationships due to the difficulty of homologizing myological features across Mammalia (Shoshani, 1993; Whidden, 2002) or even vertebrates (Diogo, 2007; Diogo et al., 2008, 2009; Diogo & Abdala, 2007, 2010). Appendix 2 is a large compilation of data standardizing muscle names and summarizing muscle attachments for most orders of mammals. See also Table 2 for a brief summary of the terminology used here in comparison with Nomina Anatomica Veterinaria (2005) and Terminologica Anatomica (1998).

A total of 60 characters were identified and scored for 46 orders or families of mammals (Appendix 3), and the program Mesquite 2.75 used for three parsimony analyses (Maddison & Maddison, 2011). The first parsimony analysis determined the ancestral states of each myological feature by optimizing them on a molecules-based phylogeny (Meredith et al., 2011). Many features of *Orycteropus*, such as a large m. panniculus carnosus with a bony insertion, are primitive states seen also in Marsupialia and in eutherian mammals that are often considered to be basal, such as *Solenodon*.

The second parsimony analysis determined the 50% majority rules consensus tree (Figure 5.1) of the 178 most parsimonious phylogenies of Mammalia calculated only from the 60 character forelimb myology data matrix. Myology places *Orycteropus* along with Tenrecidae and Macroscelididae as basal eutherian mammals. Surprisingly, the paenungulates and ungulates are nested deep in the phylogeny (Figure 5.1), providing no support for the traditional placement of *Orcyteropus* as a basal ungulate. Paenungulata retains some primitive features in common with *Orycteropus*, Afrosoricida, and Macroscelidea, but also shares derived myological features with the ungulates. Thus the myological data do not convincingly place Paenungulata within Afrotheria. The joining of Tenrecidae and Macroscelididae provides some morphological support for the Afrotheria hypothesis (Stanhope et al., 1998) but is an unusual result for morphological characters which typically group tenrecs and chrysochlorids with Eulipotyphla (Novacek, 1986; Novacek & Wyss, 1986; Asher et al., 2003; O'Leary et al., 2013). The basal position of three afrothere groups in this analysis lends support to the hypothesis that Afrotheria is the most basal clade of placental mammals (Murphy et al., 2001b; Delsuc et al., 2002; Kjer & Honeycutt, 2007; Asher, 2007; Waddell & Shelley, 2003).

The specializations of fossorial locomotion, such as the lack of most intrinsic muscles of the manus, seem to overwhelm any phylogenetic signal in the myology.

Chrysochloridae, which typically lies near Tenrecidae in both morphological and molecular phylogenies, instead forms a "mole" clade with Talpidae and Notoryctemorphia (Figure 5.1). Utilization of myological characters from regions of the body not associated with digging may ease this problem.

Finally, the third parsimony analysis determined the most parsimonious phylogeny of Afrotheria based only on the 60 character forelimb myology data matrix. The 50% majority rules consensus tree of the 23 most parsimonious trees indicates that forelimb myology places *Orycteropus* as sister group to Chrysochloridae which is supported by, for example, features of the flexor muscles of the forearm and the scapular attachment of m. dorso-epitrochlearis (Figure 5.2). In summary, the forelimb myology indicates that *Orycteropus* is most closely related to Chrysochloridae and Tenrecidae (Afrosoricida) with Macroscelididae as the sister group to this clade, together comprising Afroinsectiphilia. Thus, the myological data provide morphological support and complement the strong molecular data indicating the monophyly of Afroinsectiphilia.

In addition to myological features linking *Orycteropus* with Afrosoricida in Afroinsectiphilia, some possible myological synapomorphies for Afrotheria are identified. Most interesting is an unusual muscle named here m. cubitalis. Also, m. cleidomastoideus inserts on the manubrium in many afrotheres but not in other mammals, and the radial head of m. flexor digitorum profundus is found in most mammals including *Orycteropus, Potamogale,* and *Tenrec*, but is absent in the other afrotheres. This indicates there may be morphological support for Afrotheria in the myology.

In conclusion, the analyses presented are evidence that myological data on its own can indicate the phylogeny of a broad group of mammals. Myological data should be included in large datasets. Characters of the hind limb, head, and neck myology should also be investigated to strengthen the dataset and reduce the influence of locomotor habit. In this era of molecular sequencing, anatomical dissection can still provide valuable data and contribute to the debate over the phylogeny of Mammalia.

APPENDIX 1 - ALPHABETICAL LISTING OF ABBREVIATIONS

a – axillary nerve
A – anconeus
AD – acromiodeltoideus
ADM – abductor digiti minimi
APL – abductor pollicis longus
AT – acromiotrapezius
B – brachialis
ba – brachial artery
Bl – biceps, long head
Bs – biceps, short head
BB – biceps brachii
BR – brachioradialis
bp – brachial plexus
C – contrahentes
CB – coracobrachialis
CD – clavodeltoideus
CM – cleidomastoideus
CT – clavotrapezius
CV- cutaneous ventralis
D-C – dorsocutaneus
D-E – dorso-epitrochlearis
E-A – epitrochleo-anconeus
ECRb – extensor carpi radialis brevis
ECRl – extensor carpi radialis longus
ECU – extensor carpi ulnaris
EDC – extensor digitorum communis
EDL – extensor digitorum lateralis
EDP – extensor digitorum profunudus
F – conjoined flexor tendon
FBM- flexor digitorum breves manus
FCR – flexor carpi radialis
FCU – flexor carpi ulnaris
FDP – flexor digitorum profundus
FDPe – superficial epicondylar head
FDPd – deep epicondylar head
FDPu – ulnar head
FDPr – radial head
FDS – flexor digitorum superficialis
FPL – flexor pollicis longus
gan – great auricular nerve
H – humerus
he – hypothenar eminence
I – flexor digitorum breves profundus
IN – infraspinatus
IT – "intermediate trapezius"
i – digit 1 (pollicis)
ii – digit 2 (indicus)
iii – digit 3 (medius)
iv – digit 4 (annularis)
L – lumbricales
LD – latissimus dorsi
ltn – long thoracic nerve
m – median nerve
mc – musculocutaneus nerve
mg – mammary gland
OH – omohyoideus
OT – omotransversarius
p- pisiform
pb- profunda brachii artery
P – supinator
PA – pectoralis abdominalis
PB – palmaris brevis
PC – panniculus carnosus
PL – palmaris longus
pn – pectoral nerves
PP – pectoralis profunudus
PQ – pronator quadratus
PS – pectoralis superficialis
PSc – clavicular pec. sup.
PSd – deep pec. sup.
PSs – superficial pec. sup.
PT – pronator teres
r – radial nerve
R – radius
RC – rhomboideus cervicis
RCT – r. cervicis et thoracis
RO – rhomboideus capitis
ROC – r. capitis et cervicis
RT – rhomboideus thoracis
s – suprascapular nerve
S – supraspinatus
sa – spinal accessory nerve
SC – sphincter colli
SD – spinodeltoideus
sg – salivary gland
SM – sternomastoideus
S-S – sternoscapularis
ss – subscapular nerve
SS – subscapularis
ST – spinotrapezius
SU – subclavius
su – nerve to the subclavius
SVC – serratus ventralis cervicis
SVT – serratus ventralis thoracis
tdn – thoracodorsal nerve
TLA – triceps, laterale
TLOs – triceps, longum superficialis
TLOp – triceps, longum profundus
TME – triceps, mediale
TMA – teres major
TMI – teres minor
U – ulna
u – ulnar nerve
VC – cutaneous ventralis
v – digit 5 (minimus)
vv – vessel

+ - cubitalis
*** - sesamoid bone or cartilaginous structure**

APPENDIX 2 – MUSCLE DATA CHART

The following chart summarizes the given name, origin, and insertion of each muscle described in the anatomical descriptions referenced for this thesis.

	Tachyglossidae				Ornithorhynchidae		
	Tachyglossus Fewkes, 1878	***Tachyglossus*** Mivart, 1866	***Tachyglossus*** Walter, 1988	***Zaglossus*** Allen, 1912	***Ornithorhynchus*** Coues, 1870	***Ornithorhynchus*** Howell, 1936	***Ornithorhynchus*** McKay, 1895
PANNICULUS CARNOSUS	**panniculus carnosus** O: back and sides I: FCU; GT w/ PS;	**panniculus carnosus** O: back and sides		**panniculus carnosus** O: back and sides I: U, GT w/ PS	**panniculus carnosus** O: whole body I: U, R, H w/ PS		**panniculus carnosus** O: whole body I: U, H w/ PS
STERNO-FACIALIS							
STERNOMASTOIDEUS	**sterno-mastoideus** O: "mastoidal region" I: manubrium	**sterno-mastoid** O: mastoidal region I: manubrium		**sternomastoideus** O: mastoid region I: episternum	**sterno-mastoid, superficial portion** O: mastoid I: episternum		**episterno-cleido-mastoideus, superficial portion** O: squamosal I: medial clavicle + interclavicle
CLEIDOMASTOIDEUS				**cleidomastoideus** absent	**sterno-mastoid, deep portion** O: mastoid I: episternal bar ("essentially clavicular")		**episterno-cleido-mastoideus, deep portion** O: squamosal I: clavicle
CLAVOTRAPEZIUS				**occipitoscapularis** O: mastoid region I: vertebral border scapula			**brachio-cephalic band of panniculus** O: parietal
CEPHALOHUMERALIS							

	Tachyglossidae				Ornithorhynchidae		
	Tachyglossus Fewkes, 1878	*Tachyglossus* Mivart, 1866	*Tachyglossus* Walter, 1988	*Zaglossus* Allen, 1912	*Ornithorhynchus* Coues, 1870	*Ornithorhynchus* Howell, 1936	*Ornithorhynchus* McKay, 1895
ACROMIOTRAPEZIUS	**anterior part of trapezius**	**trapezius anterior** O: occiput I: acromion + spine scapula, lateral clavicle	**trapezius anterior** O: parietal + temporal bones I: cranial border, spine scapula, acromion, lateral clavicle	**trapezius, anterior** O: occiput + cervical midline I: lateral clavicle + cranial border scapula	**trapezius, anterior part** O: occiput, ligamentum nuchae I: spine scapula + episternal bar		**trapezius, anterior part** O: parietal, occiput, C1-2 I: vertebral border, spine, acromion, clavicle
INTERMEDIATE TRAPEZIUS / DORSO-CUTANEUS							**dermo-dorsi cervicalis** O: ribs 9-11 I: superficial to AT, neck
SPINOTRAPEZIUS	**posterior trapezius**	**trapezius posterior** O: 11T-L1 I: vertebral border scapula	**trapezius posterior** O: T verts, ribs 10-12 I: vertebral border scapula	**trapezius posterior** O: T10-L2 I: cranial edge of scapula ="spine"	**trapezius, posterior part** O: ribs 10-11 I: spine scapula		**trapezius, posterior part** O: T5-13, ribs 10-11 I: vertebral border scapula
RHOMBOIDEUS CAPITIS		**rhomboideus** O: occiput, dorsal midline I: vertebral border scapula	**rhomboid** O: parietal, cervical midline I: vertebral border scapula	**rhomboideus** O: parietal I: vertebral border scapula	**rhomboideus** O: ligamentum nuchae I: vertebral border scapula		**rhomboideus, anterior part** O: parietal, ligamentum nuchae to C4 I: vertebral border scapula
RHOMBOIDEUS CERVICIS							**rhomboideus,posterior part** O: C5 I: vertebral border scapula
RHOMBOIDEUS THORACIS							

	Tachyglossidae				**Ornithorhynchidae**		
	Tachyglossus **Fewkes, 1878**	***Tachyglossus*** **Mivart, 1866**	***Tachyglossus*** **Walter, 1988**	***Zaglossus*** **Allen, 1912**	***Ornithorhynchus*** **Coues, 1870**	***Ornithorhynchus*** **Howell, 1936**	***Ornithorhynchus*** **McKay, 1895**
OMOTRANSVERSARIUS "metacromion"		**levator claviculae** O: atlas + basioccipital I: acromion + lateral clavicle	**levator claviculae** O: atlas + axis I: acromion + clavicle	**levator scapulae ventralis** O: atlas + axis I: cranial border scapula + clavicle	**"atlanto-acromialis"** O: atlas I: spine scapula		**acromio-trachelien, ventral portion** O: atlas I: spine scapula, acromion, clavicle
OMOTRANSVERSARIUS		**levator claviculae** O: basioccipital I: cranial border scapula	**levator claviculae** O: base skull I: cranial angle	**levator scapulae ventralis** O: basioccipital I: cranial border scapula + clavicle	**"atlanto-scapularis"** O: atlas I: cranial border scapula		**acromio-trachelien, dorsal portion** O: atlas I: vertebral border + spine scapula
OMOHYOIDEUS		**omohyoid** O: hyoid I: deep surface scapula		**omohyoideus** O: border of thyroid I: cranial edge scapula	**omo-hyoid** O: hyoid w/ mylohyoid I: scapula near acromion		**omo-hyoideus** O: hyoid w/ mylohyoid I: scapula
SERRATUS VENTRALIS CERVICIS		**levator anguli scapulae** O: C1-7 I: w/ SVT vertebral border scapula, spine	**levator scapulae** O: C2-7 I: deep surface vertebral border	**serratus magnus** O: C2-7 I: deep surface vertebral border	**levatores anguli scapulae** O: C3-T1 I: deep surface scapula		**levator scapulae (2)** O: C2-7 I: deep surface vertebral border scapula
SERRATUS VENTRALIS THORACIS		**serratus magnus** O: ribs 1-4 I: w/ SVC vertebral border scapula, spine	**serratus magnus** O: ribs 1-5 I: caudal angle scapula	**serratus magnus** O: ribs 1-4 I: deep surface vertebral border	**costo-scapularis; serratus magnus s. anticus** O: ribs 1-3 I: "tip of scapula"		**serratus magnus** O: ribs 1-3 I: caudal angle scapula

	Tachyglossidae				Ornithorhynchidae		
	Tachyglossus **Fewkes, 1878**	***Tachyglossus*** **Mivart, 1866**	***Tachyglossus*** **Walter, 1988**	***Zaglossus*** **Allen, 1912**	***Ornithorhynchus*** **Coues, 1870**	***Ornithorhynchus*** **Howell, 1936**	***Ornithorhynchus*** **McKay, 1895**
CLAVODELTOIDEUS		**deltoid** O: clavicle + interclavicle I: near GT	**? Clavicular deltoid** O: acromion, clavicle, interclavicle I: deltoid tubercle w/ SD	**clavopectoralis** O: clavicle I: pectoral rdige of H	**pectoralis major - acromio-episternal bundle** O: acromion + episternal bar I: pectoral crest H		**deltoideus, acromio-clavicular portion** O: acromion + interclavicle I: DP ridge
ACROMIODELTOIDEUS							
SPINODELTOIDEUS		**deltoid** O: cranial angle scapula I: fossa on deltoid crest w/ CD	**scapular deltoid** O: cranial angle scapula I: deltoid tubercle w/ CD	**deltoideus** O: cranial border scapula I: tuberosity of H	**deltoid, posterior part** O: cranial border scapula		**deltoideus, scapular portion** O: vertebral + cranial border scapula I: middle DP ridge
TERES MINOR	**teres minor** O: scapula near glenoid I: medial H	**teres minor** absent but there is "a small delicate muscle closely connected with the outer surface of the capsular ligament"	**teres minor** O: scapula I: GT	**teres minor** absent	**subscapularis** O: superficial surface scapula I: GT		**teres minor** O: near glenoid I: between LT + GT

	Tachyglossidae				Ornithorhynchidae		
	Tachyglossus **Fewkes, 1878**	***Tachyglossus*** **Mivart, 1866**	***Tachyglossus*** **Walter, 1988**	***Zaglossus*** **Allen, 1912**	***Ornithorhynchus*** **Coues, 1870**	***Ornithorhynchus*** **Howell, 1936**	***Ornithorhynchus*** **McKay, 1895**
SUBSCAPULARIS		**subscapularis** O: superficial surface of scapula I: LT	**subscapularis + accessory subscapularis** O: superficial surface of scapula I: LT	**subscapularis + accessory subscapularis** O: superficial surface scapula I: LT	**teres major, upper** O: superficial + deep surfaces scapula I: LT (sesamoid)		**subscapularis** O: superficial + deep surfaces scapula I: LT
TERES MAJOR		**teres major** O: caudal angle scapula I: ridge distal to LT	**teres major** O: caudal angle scapula I: distal to LT	**teres major** O: caudal angle scapula I: distal to LT	**teres major, lower** O: caudal angle scapula I: posterior ridge H		**teres major** O: vertebral border scapula I: middle H
LATISSIMUS DORSI		**latissimus dorsi, anterior**	**latissimus dorsi, larger + dorsoantebrachialis**	**latissimus dorsi**	**latissimus dorsi**		**latissimus dorsi**
		O: T1-11	O: T1-11	O: T1-7	O: T4-9, ribs 7-14		O: T1-9, ribs 4-12
"superficial"		I: medial epicondyle w/ D-E	I: medial epicondyle w/ D-E	I: tuberosity of H	I: pectoral crest H		I: cranio-medial DP ridge
"deep"	"dermo flexor antebrachii"	I: w/ FCU	I: w/ FCU				I: ridge on cranio-medial H
DORSO- EPITROCHLEARIS		**dorso-epitrochlear** O: caudal angle scapula + TMA I: medial epicondyle w/ LD	**latissimus dorsi, smaller** O: caudal angle scapula + TMA I: medial epicondyle w/ LD	**latissimus dorsi, supplementary portion** O: ridge on scapula near glenoid I: w/ LD; olecranon	**dorso-epitrochlearis** O: LD I: fascia middle forearm, medial U		**dorso-epitrochlearis** O: LD costal portion I: fascia FCU

	Tachyglossidae				Ornithorhynchidae		
	Tachyglossus **Fewkes, 1878**	***Tachyglossus*** **Mivart, 1866**	***Tachyglossus*** **Walter, 1988**	***Zaglossus*** **Allen, 1912**	***Ornithorhynchus*** **Coues, 1870**	***Ornithorhynchus*** **Howell, 1936**	***Ornithorhynchus*** **McKay, 1895**
PECTORALIS SUPERFICIALIS "clavicular"							
PECTORALIS SUPERFICIALIS "superficial"		**pectoralis major** O: sternum, interclavicle, external oblique I: GT	**pectoralis major, anterior** O: sternum, interclavicle, external oblique I: w/ PSd GT	**ectopectoralis** O: manubrium I: pectoral ridge H	**pectoralis major** O: manubrium, sternum, linea alba I: pectoral crest H		**pectoralis major, anterior division** O: interclavicle, sternum, ribs 2-6 I: GT
PECTORALIS SUPERFICIALIS "deep"			**pectoralis major, posterior** O: sternum, interclavicle, external oblique I: w/ FSs GT	**entopectoralis** O: manubrium + sternum I: pectoral ridge H			**pectoralis major, posterior division** O: interclavicle, sternum, ribs 2-6 I: DP ridge w/ PC
PECTORALIS PROFUNDUS							
PECTORALIS ABDOMINALIS				**xiphihumeralis** O: xiphisternum I: pectoral ridge H at distal GT			**pectoralis quartus** O: linea alba + external oblique I: PS
SUBCLAVIUS		**subclavius** O: rib 1 I: coracoid	**costocoracoideus** O: rib 1 I: coracoid w/ CB		**pectoralis minor, costo-coracoid** O: rib 1 I: coracoid		**costo-coracoideus** O: rib 1 I: coracoid
STERNOSCAPULARIS		**coraco-brachialis** O: manubrium + interclavicle I: epicoracoid	**sternocoracoideus** O: manubrium + rib 1 I: epicoracoid		**pectoralis minor, manubrial-epicoracoid** O: manubrium + rib 1 I: epicoracoid plate		**sterno-epicoracoideus** O: manubrium + rib 1 I: epicoracoid

	Tachyglossidae				Ornithorhynchidae		
	Tachyglossus **Fewkes, 1878**	***Tachyglossus*** **Mivart, 1866**	***Tachyglossus*** **Walter, 1988**	***Zaglossus*** **Allen, 1912**	***Ornithorhynchus*** **Coues, 1870**	***Ornithorhynchus*** **Howell, 1936**	***Ornithorhynchus*** **McKay, 1895**
CORACOBRACHIALIS		**coraco-brachialis** O: coracoid I: medial epicondyle; LT	**coracobrachialis longus** O: coracoid I: medial epicondyle	**coracobrachialis caput longum** O: coracoid I: medial epicondyle	**coracobrachialis** O: coracoid I: medial epicondylar ridge		**coraco-brachialis longus** O: coracoid I: DP ridge to medial epicondyle
CORACOBRACHIALIS		**coraco-brachialis** O: epicoracoid I: LT	**coracobrachialis brevis** O: w/ CBl from coracoid I: LT	**coracobrachialis brevis** O: w/ CBl from coracoid I: LT + H	**epicoraco-brachialis** O: coracoid + epicoracoid I: middle H		**coraco-brachialis brevis** O: coracoid I: cranio-lateral H
BICEPS BRACHII, short head		**biceps** O: CB + coracoid I: R + U	**biceps brachii, smaller** O: epicoracoid I: U	**biceps, small slip** O: epicoracoid I: fuses w/ Bl	**biceps, epicoraco-radialis** O: epicoracoid I: R w/ BBl		**biceps, epicoracoid head** O: epicoracoid I: fuses w/ BBl
BICEPS BRACHII, long head			**biceps brachii, larger** O: coracoid I: 2 ins R	**biceps** O: coracoid I: R	**biceps, coraco-radialis** O: coracoid I: R w/ BBs		**biceps, coracoid head** O: coracoid I: U
BRACHIALIS		**brachialis anticus** O: lateral H I: coronoid process U	**brachialis internus** O: proximal H I: U	**brachialis** O: proximal lateral H I: U	**brachialis anticus** O: depression near pectoral crest H I: U		
CUBITALIS							
SUPRASPINATUS		**supraspinatus** O: deep surface of scapula I: GT	**supraspinatus** O: dorsal to glenoid I: GT	**supraspinatus** O: deep surface scapula I: GT	**supraspinatus** O: deep surface scapula I: GT		**supraspinatus** O: deep surface scapula I: GT

	Tachyglossidae				Ornithorhynchidae		
	Tachyglossus Fewkes, 1878	*Tachyglossus* Mivart, 1866	*Tachyglossus* Walter, 1988	*Zaglossus* Allen, 1912	*Ornithorhynchus* Coues, 1870	*Ornithorhynchus* Howell, 1936	*Ornithorhynchus* McKay, 1895
INFRASPINATUS		**infraspinatus** O: surface of scapula I: GT		**infraspinatus** O: surface of scapula I: GT	**infraspinatus and teres minor?** O: surface of scapula I: pectoral crest H		**infraspinatus** O: surface of scapula I: GT
TRICEPS BRACHII CAPUT LATERALE		**triceps, distinct slip** O: distal GT I: w/TLO	**Westling's 'Tr. IIII'** O: distal to H head I: w/ TME	**triceps caput laterale** O: proximal ateral H I: lateral olecranon w/ TME	**triceps, external head** O: near GT + neck H (2) I: lateral olecranon		**triceps, external humeral head** O: proximal H near GT I: olecranon
TRICEPS BRACHII CAPUT MEDIALE		**triceps, humeral** O: caudal H I: olecranon	**triceps brachii, humeral heads** O: caudal H I: olecranon	**triceps caput mediale** O: caudal H I: medial olecranon	**triceps, internal head** O: caudal H I: olecranon		**triceps, proximal internal humeral head** O: proximal caudal H I: olecranon
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)		**triceps, scapular** O: caudal border scapula I: olecranon	**triceps brachii, scapular** O: spine scapula I: olecranon	**triceps caput longum** O: neck of scapula I: olecranon	**triceps, long head** O: caudal border scapula I: olecranon		**triceps, scapular portion** O: caudal border scapula I: olecranon
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)							
TRICEPS BRACHII ACCESSORY							
ANCONEUS		**anconeus** O: caudal surface lateral epicondyle I: fossa distal to sigmoid cavity U	**anconeus quartus** O: caudal surface lateral epicondyle I: fossa lateral olecranon	**anconeus** O: distal tubercle H I: olecranon	**anconaeus** O: distal H I: cranial olecranon	**ext humero-ulnaris - anconeus** O: lateral epicondyle I: U	**triceps, distal internal humeral head** O: distal caudal H I: olecranon

	Tachyglossidae				Ornithorhynchidae		
	Tachyglossus Fewkes, 1878	***Tachyglossus*** Mivart, 1866	***Tachyglossus*** Walter, 1988	***Zaglossus*** Allen, 1912	***Ornithorhynchus*** Coues, 1870	***Ornithorhynchus*** Howell, 1936	***Ornithorhynchus*** McKay, 1895
BRACHIORADIALIS		**supinator longus** O: caudo-lateral H I: cranial R	**supinator longus** O: proximal H I: R	**brachioradialis** O: lateral H I: R		**brachioradialis** O: lateral epicondyle I: R	
EXT CARPI RADIALIS, longus (MC2)		**ext carpi radialis longior** O: lateral epicondyle I: scapholunar	**ext carpi radialis longus** O: cranial surface lateral epicondyle I: scapholunare	**ext carpi radialis longus** O: lateral supracondylar ridge I: scapholunar	**flx carpi radialis** O: lateral epicondylar ridge I: base MC2,3,4	**ext humeroradialis - ext carpi radialis longus** O: lateral epicondyle I: MC2, 3, 4	
EXT CARPI RADIALIS, brevis (MC3)		**ext carpi radialis brevior** O: lateral epicondyle I: MC 3	**ext carpi radialis brevis** O: lateral epicondyle I: MC 3	**ext carpi radialis brevis** O: lateral supracondylar ridge I: MC 3	**supinator longus** O: cranial lateral epicondyle I: radial carpus	**ext humeroradialis - ext carpi radialis brevis** O: lateral epicondyle I: scapholunar	
EXT DIGITORUM COMMUNIS		**ext communis digitorum** O: lateral epicondyle + U I: digits 2, 3, 4	**ext digitorum communis** O: lateral epicondyle + U I: digits 2, 3, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle + U I: digits 2, 3, 4	**ext digitorum communis** O: lateral epicondyle I: digits 1-5	**ext humerodorsalis - ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	
EXT DIGITORUM LATERALIS		**ext minimi digiti** O: lateral epicondyle I: digit 4	**ext digiti minimi** O: lateral epicondyle I: digits 4, 5	**ext digitorum lateralis** O: lateral epicondyle I: digit 4	**ext minimi digiti** O: lateral epicondyle I: digit 5		

	Tachyglossidae				Ornithorhynchidae		
	Tachyglossus **Fewkes, 1878**	***Tachyglossus*** **Mivart, 1866**	***Tachyglossus*** **Walter, 1988**	***Zaglossus*** **Allen, 1912**	***Ornithorhynchus*** **Coues, 1870**	***Ornithorhynchus*** **Howell, 1936**	***Ornithorhynchus*** **McKay, 1895**
EXT CARPI ULNARIS		**ext carpi ulnaris** O: lateral epicondyle + olecranon I: digit 5	**ext carpi ulnaris** O: lateral epicondyle + olecranon I: digit 5	**ext carpi ulnaris** O: lateral epicondyle + olecranon I: digit 5	**flx carpi ulnaris** O: U I: base MC5	**ext humero-ulnaris - ext carpi ulnaris** O: lateral epicondyle I: digit 5	
SUPINATOR		**supinator brevis** O: lateral epicondyle I: R	**supinator brevis** O: lateral epicondyle I: R	**supinator** O: lateral epicondyle I: R	**supinator brevis** O: lateral epicondyle I: middle R		
ABD POLLICIS LONGUS		**ext ossis metacarpi pollicis** O: U + interosseus ligament I: MC1	**ext ossis metacarpi pollicis** O: proximal U + interosseus ligament I: MC1	**ext brevis pollicis** O: U + interosseus ligament I: MC1	**ext ossis metacarpi pollicis** O: U + R I: base MC1	**ulnocarpal series - abd pollicis longus** O: U I: MC1	
EXT DIGITORUM PROFUNDUS		**ext indicis** absent			**ext digitorum communis** O: EDC I: delicate abortive tendon	**ulnocarpal series - ext indicis proprius** O: U I: digits 1, 2, 3	
EXT BREVIS DIGITORUM							
PRONATOR TERES		**pronator teres** O: medial epicondyle I: R	**pronator teres** O: medial epicondyle I: R + carpus	**pronator teres** O: medial epicondyle I: R	**pronator radii teres** O: medial epicondyle I: middle R	**flx humeroradialis - pronator teres** O: medial epicondyle I: R	

	Tachyglossidae				Ornithorhynchidae		
	Tachyglossus **Fewkes, 1878**	***Tachyglossus*** **Mivart, 1866**	***Tachyglossus*** **Walter, 1988**	***Zaglossus*** **Allen, 1912**	***Ornithorhynchus*** **Coues, 1870**	***Ornithorhynchus*** **Howell, 1936**	***Ornithorhynchus*** **McKay, 1895**
FLX CARPI RADIALIS		**flx carpi radialis** O: medial epicondyle I: mecarpals 1 + 2	**flx carpi radialis** O: medial epicondyle I: sesamoid bone, mecarpals 1 + 2	**flx carpi radialis** O: medial epicondyle I: mecarpals 1 + 2	**ext carpi radialis** O: medial epicondyle + R I: radial carpal bone	**flx humeroradialis - flx carpi radialis** O: medial epicondyle I: radial sesamoid	
PALMARIS LONGUS		**palmaris longus** fused w/ FDP		**palmaris longus** absent	**palmaris longus** possibly combined w/ FDP		
FLX DIGITORUM SUPERFICIALIS				**flexor sublimis digitorum** absent	**flx digitorum sublimis s. perforatus** O: FDP I: delicate tendons to digits	**superficial podial flexors - flx digitorum breves sublimis** O: FDP tendon I: digits 1, 3, 4	
INTERFLEXORII							
FLX DIGITORUM PROFUNDUS,	**flx communis digitorum**	**flx communis digitorum**	**flx digitorum communis**	**flx profundus digitorum**	**flx digitorum communis**	**flx humeropalmaris & ulnopalmar flx series - flx digitorum longus**	
epicondylar				O: medial epicondyle			
epicondylar (FDPe)		O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	
epicondylar (FDPd)		O: medial epicondyle		O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	
ulnar		O: U	O: U	O: U	O: U	O: U	
radial							
	*I: digits 1-5	*I: digits 1-5	*I: digits 1-5	*I: digits 2-4	*I: digits 1-5		

	Tachyglossidae				Ornithorhynchidae		
	Tachyglossus **Fewkes, 1878**	***Tachyglossus*** **Mivart, 1866**	***Tachyglossus*** **Walter, 1988**	***Zaglossus*** **Allen, 1912**	***Ornithorhynchus*** **Coues, 1870**	***Ornithorhynchus*** **Howell, 1936**	***Ornithorhynchus*** **McKay, 1895**
LUMBRICALES	**lumbricales** O: FDP I: digits 2, 3, 3, 4	**lumbricales** O: FDP I: digits 2, 3, 3, 4	**lumbricals** O: FDP I: digits 2, 2, 3, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 3, 4	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 3, 4, 5	
FLX CARPI ULNARIS, **epitrochlear belly** **ulnar belly**		**flx carpi ulnaris** O: medial epicondyle O: medial olecranon + U I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: medial olecranon I: pisiform + metacarpal 4	**flx carpi ulnaris** O: medial epicondyle O: medial olecranon I: pisiform	**ext carpi ulnaris** O: medial epicondyle O: medial U I: pisiform	**flx humero-ulnaris - flx carpi ulnaris** O: medial epicondyle O: medial U I: pisiform	
EPITROCHLEO-ANCONEUS		**muscular fasiculus** O: medial epicondyle I: medial olecranon	**epitrochleoancone us** O: medial epicondyle I: apex olecranon		**antanconaeus** O: medial epicondyle I: medial olecranon	**flx humero-ulnaris - epitrochleo-anconeus** O: medial epicondyle I: medial olecranon	
PRONATOR QUADRATUS		**pronator quadratus** absent				**ulnopalmar flexor series - pronator quadratus** absent	
PALMARIS BREVIS							
FLX DIGITORUM BREVIS MANUS							
ABD DIGITI MINIMI			**flx carpi ulnaris**	**abd digiti minimi** O: pisiform I: digit 5	**abductor** O: pisiform I: digit 5		

	Tachyglossidae				Ornithorhynchidae		
	Tachyglossus **Fewkes, 1878**	***Tachyglossus*** **Mivart, 1866**	***Tachyglossus*** **Walter, 1988**	***Zaglossus*** **Allen, 1912**	***Ornithorhynchus*** **Coues, 1870**	***Ornithorhynchus*** **Howell, 1936**	***Ornithorhynchus*** **McKay, 1895**
ABD POLLICIS BREVIS	**abd pollicis** O: trapezium I: radial pollex	**abd pollicis** O: trapezium I: radial pollex	**abd pollicis** O: FDP I: pollex				
CONTRAHENTES	**lumbricales + "an anomaly"** O: deep to FDP I: digits 4, 5; fascia over digits 2+3			**?** O: deep to FDP I: fascia between digits 2+3; 3+4; and 4+5	**adductor** O: palm I: digit 5	**deep podial flexors - contrahentes** absent	
FLEXOR BREVES PROFUNDUS	**interossei** 7 I: pair digits 1, 2, 3, single 4	**interossei** 8 I: pairs digits 1, 2, 3, 4		**interossei + add pollicis** 7 I: pairs digits 2, 3, single digit 1, 4, 5	**interossei** 4	**flx digitorum breves profundi (interossei)** 10	
INTERMETACARPALES						**intermetacarpales** absent	
? Unknown homology	**flx brevis pollicis** O: FDP tendon I: radial pollex		**epicoracobrachialis** O: epicoracoid I: LT	**epicoracobrachialis** O: epicoracoid I: LT			**epicoraco-brachialis** O: epicoracoid I: LT (sesamoid)
? Unknown homology		**? Epicoraco-humeral** O: epicoracoid I: H near GT	**supracoracoideus** O: epicoracoid I: GT		**deltoid, anterior part** O: epicoracoid I: pectoral crest H		**epicoraco-humeralis** O: epicoracoid I: GT + caudal H
? Unknown homology					**anconaeus, superficial portion** O: lateral epicondyle I: lateral U		
RADIAL SESAMOID = "pre-pollux"							
ULNAR SESAMOID							
CARPAL VIBRISSAE							
OTHER		ossicles in flx tendon					

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
PANNICULUS CARNOSUS			**dermo-brachialis (panniculus carnosus)** O: back + sides + belly I: lateral bicipital groove w/ pectorals				
STERNO-FACIALIS							
STERNOMASTOIDEUS	**sterno-mastoid** O: mastoid I: manubrium		**sterno-mastoideus** O: mastoid I: manubrium				
CLEIDOMASTOIDEUS	**cleido-mastoid** O: occiput I: medial clavicle		**cleido-mastoid / cleido-mastoideus** O: mastoid I: medial clavicle				
CLAVOTRAPEZIUS	**cleido-occipital** O: occipital crest I: middle clavicle						

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
CEPHALOHUMERALIS							
ACROMIOTRAPEZIUS	**trapezius** O: occipital crest, C-T vertebrae I: spine scapula	**trapezius** O: occipital crest, C-T13, lumbar fascia I: clavicle, acromion, spine scapula	**trapezius** O: occiput, C1-T13 I: lateral clavicle, acromion, spine scapula	**trapezius** O: occiput, C1-T13 I: lateral clavicle, acromion, spine scapula		**trapezius** O: occipital crest, C-T13, lumbar fascia I: clavicle, acromion, spine scapula	
DELTOTRAPEZIUS							
DORSO-CUTANEUS							
SPINOTRAPEZIUS							
RHOMBOIDEUS CAPITIS	**rhomboideus** O: occipital crest, C1-T5 I: vertebral border scapula	**rhomboideus** O: occipital crest, C1-T2 I: vertebral border scapula	**rhomboideus** O: occipital crest, C-mid T I: vertebral border scapula	**rhomboideus** O: occipital crest, C1-T4 I: vertebral border scapula		**rhomboideus** O: occipital crest, C1-T2 I: vertebral border scapula	

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
RHOMBOIDEUS CERVICIS							
RHOMBOIDEUS THORACIS							
OMOTRANSVERSARIUS "metacromion" ventral	**levator scapulae** O: atlas I: acromion + spine scapula + vertebral border scapula	**atlanto-acromialis** O: atlas I: acromion + spine scapula	**atlanto-acromialis** O: atlas I: base acromion + spine scapula	**atlanto-acromialis** O: atlas I: acromion + spine scapula + fascia deltoid		**atlanto-acromialis** O: atlas I: acromion + spine scapula	
OMOTRANSVERSARIUS dorsal	**acromio-trachelien** O: atlas + basioccipital I: spine + vertebral border scapula	**atlanto-scapularis** O: atlas I: spine scapula + vertebral border scapula	**atlanto-scapularis** O: atlas I: deep surface cranial angle scapula	**atlanto-scapularis** O: atlas I: vertebral border scapula		**atlanto-scapularis** O: atlas I: cranial border scapula	
OMOHYOIDEUS	**omo-hyoid** O: hyoid I: vertebral border scapula	**omohyoideus** O: hyoid I: cranial angle scapula	**omo-hyoideus** O: hyoid I: deep surface cranial angle scapula	**omohyoid** O: hyoid I: cranial angle + vertebral border scapula		**omohyoideus** O: hyoid I: superficial to S	

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
SERRATUS VENTRALIS CERVICIS		**levator anguli scapulae** O: w/ SVT	**levator anguli scapulae** O: w/ SVT	**serratus ventralis** O: w/ SVT		**levator anguli scapulae** O: w/ SVT	
SERRATUS VENTRALIS THORACIS	**serratus magnus** O: C2-7, ribs 1-7 I: deep surface vertebral border scapula	**serratus magnus** O: C4-7, ribs 1-7 I: vertebral border scapula	**serratus magnus** O: C3-7, ribs 1-9 I: vertebral border scapula	**serratus ventralis** O: C3-7, ribs 1-9 I: deep surface vertebral border scapula		**serratus magnus** O: C4-7, ribs 1-9 I: vertebral border scapula	
CLAVODELTOIDEUS	**deltoid, clavicular** O: lateral clavicle, acromion I: proximal cranial H w/ PS	**clavodeltoid** O: lateral clavicle + acromion I: deltoid tuberosity H	**deltoid** O: lateral clavicle, acromion, spine scapula I: tubercle on cranial H	**deltoid** O: clavicle, acromion, spine scapula I: distal DP crest H		**clavodeltoid** O: lateral clavicle + acromion I: deltoid tuberosity H	

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
ACROMIODELTOIDEUS							
SPINODELTOIDEUS	**deltoid, scapular** O: spine scapula I: proximal cranial H	**scapulodeltoid** O: spine scapula I: deltoid tuberosity H				**scapulodeltoid** O: spine scapula I: deltoid tuberosity H	
TERES MINOR	**teres minor** O: caudal border scapula I: distal to IN	**teres minor** O: caudal border scapula I: GT	**teres minor** absent			**teres minor** O: caudal border scapula I: GT distal to IN	

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: medial H near neck	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT		**subscapularis** O: subscapular fossa I: LT	
TERES MAJOR	**teres major** O: caudal angle scapula I: medial bicipital groove H	**teres major** O: caudal border scapula I: medial bicipital groove H	**teres major** O: caudal angle scapula I: medial bicipital groove H	**teres major** O: caudal angle scapula I: crest medial H		**teres major** O: caudal border scapula I: medial bicipital groove H	
LATISSIMUS DORSI "superficial" "deep"	**latissimus dorsi** O: T vertebrae + lumbar fascia I: medial bicipital groove H	**latissimus dorsi** O: T4-L4 I: medial bicipital groove H	**latissimus dorsi** O: middle T-L4 I: medial bicipital groove H	**latissimus dorsi** O: T5-L4 I: medial middle H		**latissimus dorsi** O: T4-L4 I: medial bicipital groove	

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
DORSO-EPITROCHLEARIS	**dorsi epitrochlear** O: LD I: fascia medial arm + olecranon	**tensor fasciae antebrachii** O: LD I: medial olecranon	**omo-anconeus** O: LD I: medial olecranon	**dorso-epitrochlearis** O: LD I: olecranon		**tensor fasciae antebrachii** O: LD I: medial olecranon	
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis major** O: sternum I: lateral bicipital groove H		**pectoralis major, first part** O: manubrium + sternum I: lateral bicipital groove H	**pectoralis, superficial** O: sternum I: DP crest H			
PECTORALIS SUPERFICIALIS "deep"	**pectoralis major, underlies preceeding** O: sternum I: lateral bicipital groove H		**pectoralis major, second divison** O: sternum I: GT + proximal lateral bicipital groove H	**pectoralis, deep** O: sternum I: proximal DP crest H + GT			

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
PECTORALIS PROFUNDUS							
PECTORALIS ABDOMINALIS	**pectoralis quartus** O: fascia thorax I: lateral bicipital groove H		**pectoralis major, third divison** O: linea alba I: proximal lateral bicipital groove near GT	**pectoralis, posterior** O: linea alba + xiphoid process I: proximal DP crest H			
SUBCLAVIUS	**subclavius** O: rib 1 I: lateral clavicle	**subclavius** O: rib 1 I: lateral clavicle	**subclavius** O: rib 1 I: lateral clavicle, acromion, acromio-clavicular ligament	**subclavius** O: rib 1 I: lateral clavicle, acromion		**subclavius** O: rib 1 I: lateral clavicle	
STERNOSCAPULARIS	**subclavius** O: lateral clavicle I: acromion	**cleidoacromialis** O: lateral clavicle I: spine scapula	**cleido-acromialis** O: clavicle I: acromion + spine scapula			**cleidoacromialis** O: lateral clavicle I: spine scapula	

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
CORACOBRACHIALIS	**coraco-brachialis (brevis)** O: coracoid I: medial neck H	**coracobrachialis** O: coracoid I: medial H near LT	**coraco-brachialis** O: coracoid I: medial H			**coracobrachialis** O: coracoid I: medial H near LT	
CORACOBRACHIALIS							
BICEPS BRACHII, short head	**biceps (coraco-radial)** O: coracoid + glenoid I: R	**biceps brachii** O: coracoid I: proximal medial R	**biceps** O: coracoid (+ glenoid) I: R			**biceps brachii** O: coracoid I: proximal medial R	
BICEPS BRACHII, long head	**biceps (gleno-ulnar)** O: glenoid I: coronoid process U w/ B		**biceps** O: glenoid (+ coracoid) I: coronoid process U w/ B				

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
BRACHIALIS	**brachialis anticus** O: lateral H I: U	**brachialis** O: lateral H I: coronoid process U	**brachialis anticus** O: lateral H I: coronoid process U w/ BB			**brachialis** O: lateral H I: coronoid process U	
CUBITALIS							
SUPRASPINATUS	**supraspinatus** O: supraspinous fossa I: cranial neck H	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT		**supraspinatus** O: supraspinous fossa I: GT	
INFRASPINATUS	**infraspinatus** O: infraspinous fossa I: distal to S	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT		**infraspinatus** O: infraspinous fossa I: GT	
TRICEPS BRACHII CAPUT LATERALE	**triceps, outer** O: caudo-medial H I: lateral olecranon + w/ TLO	**triceps brachii - caput lateralis** O: caudal H I: olecranon	**triceps, humeral heads** O: caudal H I: olecranon w/ TLO	**triceps, lateral head** O: caudal H I: olecranon w/ TME		**triceps brachii - caput lateralis** O: caudal H I: olecranon	

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
TRICEPS BRACHII	**triceps, inner**	**triceps brachii - caput medialis**	**triceps brachii - caput medialis**	**triceps, medial head**		**triceps brachii - caput medialis**	
CAPUT MEDIALE	O: caudo-medial H	O: caudo-medial H	O: caudo-medial H	O: distal caudal H		O: caudo-medial H	
	I: medial olecranon + w/ TLO	I: olecranon	I: olecranon	I: olecranon w/ TLA		I: olecranon	
TRICEPS BRACHII	**triceps, long**	**triceps brachii - caput longus**	**triceps, scapular head**	**triceps, scapular head**		**triceps brachii - caput longus**	
CAPUT LONGUM	O: caudal border scapula	O: caudal border scapula	O: caudal border scapula	O: caudal border scapula		O: caudal border scapula	
"tendon portion" (deep)	I: olecranon	I: olecranon	I: olecranon w/ TME + TLA	I: olecranon		I: olecranon	
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)							
TRICEPS BRACHII ACCESSORY							

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
ANCONEUS	**anconeus externus** O: lateral epicondyle I: olecranon	**anconeus externus** O: lateral epicondyle I: olecranon				**anconeus externus** fused w/ TLA	
BRACHIORADIALIS	**supinator longus** O: lateral supracondyloid ridge H I: dorsal carpus	**brachioradialis** O: lateral supracondylar ridge I: radial carpus	**supinator longus** O: lateral supracondyloid ridge H I: radial carpus			**brachioradialis** O: lateral supracondylar ridge I: radial carpus	
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis longior** O: lateral supracondylar ridge I: MC2	**ext carpi radialis longus** O: lateral supracondylar ridge I: MC2	**ext carpi radialis "longior"** O: lateral supracondyloid ridge H I: base MC2		**ext carpi radialis longus** O: supracondylar ridge I: MC2	**ext carpi radialis longus** O: lateral supracondylar ridge I: MC2	
EXT CARPI RADIALIS, brevis (MC3)	**ext carpi radialis brevior** O: lateral supracondylar ridge I: MC3	**ext carpi radialis brevis** O: lateral supracondylar ridge I: MC3	**ext carpi radialis brevior** O: lateral supracondyloid ridge H I: base MC3		**ext carpi radialis brevis** O: supracondylar ridge I: MC3	**ext carpi radialis brevis** O: lateral supracondylar ridge I: MC3	

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
EXT DIGITORUM COMMUNIS	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5		**ext digitorum communis** O: lateral epicondyle I: base distal phalanges dig 1, 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	
EXT DIGITORUM LATERALIS	**ext minimi digiti** O: lateral epicondyle I: digits 4, 5	**ext digitorum lateralis** O: lateral epicondyle I: digits 4, 5	**ext minimi digiti** O: lateral epicondyle I: digits 4, 5		**ext digitorum ulnaris** O: lateral epicondyle I: base distal phalanges dig 4 + 5	**ext digitorum lateralis** O: lateral epicondyle I: digits 4, 5	
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle + olecranon I: inner wrist	**ext carpi ulnaris** O: lateral epicondyle + olecranon I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + olecranon I: base MC5		**ext carpi ulnaris** O: lateral epicondyle + olecranon I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + olecranon I: base MC5	
SUPINATOR	**supinator brevis** O: lateral epicondyle I: R	**supinator** O: lateral epicondyle I: proximal 2/3 R	**supinator brevis** O: lateral epicondyle I: R		**supinator** O: lateral epicondyle I: proximal 1/3 R	**supinator** O: lateral epicondyle I: proximal 1/2 R	

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
ABD POLLICIS LONGUS	**ext ossis metacarpi pollicis** O: U + R I: base MC1	**abd pollicis longus** O: proximal R + U I: MC1	**ext ossis metacarpi pollicis** O: R + U I: base MC1		**abd pollicis longus** O: lateral R + U I: base MC1	**abd pollicis longus** O: proximal R + U I: MC1	
EXT DIGITORUM PROFUNDUS	**ext secundi internodii pollicis** O: medial olecranon + U I: digit 1, 2	**ext indicis proprius** O: proximal 2/3 U I: digits 1, 2	**ext indicis (et pollicis)** O: U I: digits 1, 2		**ext digitorum profundus** O: U I: distal phalanges digits 1 + 2	**ext indicis proprius** O: proximal 2/3 U I: digits 1, 2	
EXT POLLICIS LONGUS							
EXT BREVIS DIGITORUM					-		
PRONATOR TERES	**pronator radii teres** O: medial epicondyle I: lateral middle R	**pronator teres** O: medial epicondyle I: distal R	**pronator radii teres** O: medial epicondyle I: middle R		**pronator teres** O: medial epicondyle I: cranial R	**pronator teres** O: medial epicondyle I: distal R	

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: medial base MC3	**flx carpi radialis** O: medial epicondyle I: base MC2	**flx carpi radialis** O: medial epicondyle I: base MC2		**flx carpi radialis** O: medial epicondyle I: scaphoid	**flx carpi radialis** O: medial epicondyle I: base MC2	
PALMARIS LONGUS	**palmaris longus** O: medial epicondyle I: FDP in palm	**palmaris longus** O: FCU + FDP I: palmar fascia	**palmaris longus** O: medial epicondyle I: palmar fascia, radial sesamoid, pisiform		**palmaris longus** O: medial epicondyle + FDP I: palmar aponeurosis	**palmaris longus** O: FCU + FDP I: palmar fascia	
FLX DIGITORUM SUPERFICIALIS	**flx digitorum sublimis** O: distal FDP I: digits 2, 3, 4	**flx digitorum superficialis** O: distal 1/3 H + medial epicondyle I: digits 2, 3, 4, 5	**flx digitorum communis sublimis s. perforatus** O: caudal medial epicondyle + FDP I: digits 2, 3, 4, 5		**flx digitorum superficialis** O: medial epicondyle I: base middle phalanges digits 2, 3, 4, 5	**flx digitorum superficialis** O: medial epicondyle I: digits 2, 3, 4, 5	

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
INTERFLEXORII					-		
FLX DIGITORUM PROFUNDUS, **epicondylar**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum communis profundus s. perforans**		**flx digitorum profundus**	**flx digitorum profundus**	
epicondylar (FDPe)	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle		O: medial epicondyle	O: medial epicondyle	
epicondylar (FDPd)		O: medial epicondyle (FPL)	O: vestigial belly, medial epicondyle			O: medial epicondyle (FPL)	
ulnar	O: medial olecranon + U	O: medial olecranon + U	O: medial olecranon + 2/3 U		O: medial olecranon + U	O: medial olecranon + U	
radial	O: proximal 1/3 R	O: R shaft	O: proximal half R		O: R shaft	O: R shaft	
	*I: base distal phalanges 1, 2, 3, 4, 5	*I: base distal phalanges 1, 2, 3, 4, 5	*I: base distal phalanges 1, 2, 3, 4, 5		*I: base distal phalanges 1, 2, 3, 4, 5	*I: base distal phalanges 1, 2, 3, 4, 5	

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
LUMBRICALES	**lumbricales** O: FDP I: lateral 3, 4, 5	**lumbricales** O: FDP I: medial 2, 3, 4, 5	**lumbricales** O: FDP I: medial 2, 3, 4, 5		**lumbricals** O: FDP I: medial 2, 3, 4, 5	**lumbricales** O: FDP I: medial 2, 3, 4, 5	
FLX CARPI ULNARIS, **epitrochlear belly** **ulnar belly**	**flexor carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform + MC5	**flexor carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform	**flexor carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform		**flexor carpi ulnaris** O: olecranon process I: pisiform	**flexor carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform	
EPITROCHLEO-ANCONEUS	**anconeus internus** O: caudal medial epicondyle I: medial olecranon	**anconeus internus** O: medial condyle I: medial olecranon	**-----? anconeus** O: medial condyle I: medial olecranon			**anconeus internus** O: medial condyle I: medial olecranon	
PRONATOR QUADRATUS	**pronator quadratus** I: distal 1/2 R + U	**pronator quadratus** I: distal 1/2 R + U	**pronator quadratus** "usual" I: distal R + U		**pronator quadratus** O: distal 1/3 U I: distal 1/3 R	**pronator quadratus** I: distal 1/3 R + U	

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes **Sidebotham, 1885**	***Chironectes*** **Stein, 1981**	***Didelphis*** **Coues, 1872**	***Didelphis*** **Jenkins & Weijs, 1979**	***Didelphis*** **Linkinhoker, 1997**	***Didelphis*** **Stein, 1981**	***Didelphis*** **Young, 1880**
PALMARIS BREVIS							
FLX DIGITORUM BREVES MANUS							
ABD DIGITI MINIMI	**abd digiti minimi** O: pisiform + annular ligament I: digit 5	**abd digiti minimi** O: flx retinaculum I: digit 5	**abd digiti minimi** O: pisiform I: digit 5		**abductor digiti quint brevis** O: flexor retinaculum I: lateral digit 5	**abd digiti minimi** O: pisiform I: digit 5	**abd minimi digiti** O: unciform + annular ligament I: digit 5
ABD POLLICIS BREVIS	**abd pollicis** O: trapezium, scaphoid, annular ligament I: digit 1	**abd pollex** O: trapezium, flexor retinaculum I: digit 1	**abd pollicis** O: trapezium, flexor retinaculum I: digit 1		**abd pollicis brevis** O: flexor retinaculum I: medial digit 1	**abd pollex** O: trapezium, flexor retinaculum, radial sesamoid I: digit 1	**abd pollicis** O: trapezium, sesamoid in tendon APL I: digit 1
CONTRAHENTES	**palmar group** O: palm I: 1L, 2L, 3L, 4M, 5M	**add pollicis, add digiti minimi** O: MC3 I: 1L, 2L, 4M, 5M	**add pollicis, digiti minimi** O: MC3 I: 1L, 5M		**contrahentes** O: MC3 I: 1L, 2L, 4M, 5M	**add pollicis, add digiti minimi** O: MC3 I: 1L, 2L, 4M, 5M	**palmar group** O: MC3 I: 1L, 2L, 4M, 5M

	DIDELPHIMORPHIA						
	Didelphidae						
	Chironectes Sidebotham, 1885	*Chironectes* Stein, 1981	*Didelphis* Coues, 1872	*Didelphis* Jenkins & Weijs, 1979	*Didelphis* Linkinhoker, 1997	*Didelphis* Stein, 1981	*Didelphis* Young, 1880
FLEXOR BREVES PROFUNDUS	**intermediate group** 10	**intermediate group** 10	**palmar interossei** ?		**flexor pollicis brevis & ventral interroseus** 10	**intermediate group** 10	**intermediate group** 10
INTERMETACARPALES	**dorsal interossei** 4	**interossei** 4	**dorsal interossei** 4			**interossei** 4	**dorsal interossei** 4
? Unknown homology	**chondro-humeral** O: external oblique I: w/ PA	**opponens pollicis** absent	**opponens pollicis** O: MC1 I: digit 1			**opponens pollicis** absent	**opponens pollicis** absent
? Unknown homology		**opponens minimi digiti** O: pisiform I: lateral digit 5	**opponens minimi digiti** O: pisiform + flx retinaculum I: lateral digit 5			**opponens minimi digiti** O: pisiform I: lateral digit 5	**opponens minimi digiti** I: lateral MC5
RADIAL SESAMOID "PRE-POLLUX"							
ULNAR SESAMOID							
CARPAL VIBRISSAE							

	PAUCITUBERCULATA	NOTORYCTEMORPHIA		DASYUROMORPHIA				
	Caenolestidae	Notoryctidae		Dasyuridae				Thylacinidae
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
PANNICULUS CARNOSUS	**panniculus** O: back + sides I: medial deltoid ridge H	**panniculus carnosus**	**panniculus** O: thorax + abdomen I: tendinous arch crossing axillary vessels	**panniculus carnosus**			**panniculus carnosus** "weak and undefined"	
STERNO-FACIALIS								
STERNOMASTOIDEUS	**sterno-mastoideus** O: occipital crest; mastoid (2 parts) I: manubrium	**sternoscephalis pars mastoidea** O: mastoid/occipital I: manubrium, clavicle	**sternomastoideus** O: mastoid I: manubrium	**sternomastoideus** O: mastoid/occipital I: manubrium	**sterno-mastoid** O: mastoid process I: manubrium			
CLEIDOMASTOIDEUS	**cleido-mastoideus** O: mastoid I: lateral clavicle		**cleido-mastoid** absent	**cleidomastoideus** O: mastoid process I: medial clavicle	**cleido-mastoid** O: mastoid process I: medial clavicle	**cleido-mastoid** O: mastoid process I: medial clavicle		**cleido-mastoid** O: mastoid process I: medial clavicle + CD
CLAVOTRAPEZIUS	**cleido-occipitalis** O: occiput I: medial clavicle	**cleido-trapezius** O: occipital crest, C verts I: lateral clavicle	**cleido-trapezius** O: occipital crest, C verts I: lateral clavicle		**cleido-occipital** O: occipital crest I: middle clavicle	**cleido-occipital** O: occipital crest w/ AT I: medial clavicle		**cleido-occipital** absent

	PAUCITUBER CULATA	NOTORYCTEMORPHIA		DASYUROMORPHIA				
	Caenolestidae	**Notoryctidae**		**Dasyuridae**				**Thylacinidae**
	***Caenolestes* Osgood, 1921**	***Notoryctes* Warburton, 2003**	***Notoryctes* Wilson, 1894**	***Dasycercus* Jones, 1949**	***Dasyurus* MacCormick, 1886**	***Phascogale* Cunningham, 1882**	***Sarcophilus* Macalister, 1870**	***Thylacinus* Cunningham, 1882**
CEPHALOHUMERALIS				**ATa / AD**	SM deep to PS	**ATa / AD**		**ATa + CM / CD**
ACROMIOTRAPEZIUS	**acromio-trapezius** O: occipital crest, C-T5 vertebrae I: metacromion, spine scapula	**acromio-trapezius + delto-trapezius** O: occipital crest, C-T1 vertebrae I: w/ deltoideus, acromion + spine scapula	**acromio-trapezius + delto-trapezius** O: occipital crest, C-T1 vertebrae I: w/ CD, clavicle, acromion + spine scapula	**trapezius** O: occipital crest, C1-T? I: clavicle, AD, spine scapula, fascia IN	**trapezius** O: occipital crest, C1-T? I: H w/ deltoids, metacromion, spine scapula	**trapezius** O: occipital crest, C1-T7 I: clavicle + AD, acromion + spine scapula	**trapezius** O: occipital crest, C1-T9 I: lateral clavicle + acromion + spine scapula	**trapezius** O: occipital crest, C1-T7 I: clavicle + CD, acromion + spine scapula
DELTOTRAPEZIUS		*	*	*	*	*		*
DORSO-CUTANEUS	**dorso-cuticularis** O: T12 I: PC							
SPINOTRAPEZIUS	**spino-trapezius** O: T5-12 I: middle spine scapula	**spino-trapezius** O: T7-9 I: spine scapula	**spino-trapezius** O: T7-11 I: spine scapula					
RHOMBOIDEUS CAPITIS	**r. minor (capitis)** O: mastoid, squamosal, supraoccipital I: w/ RC vertebral border near base spine scapula	**rhomboideus** O: occipital crest, C-T2 I: spine scapula + vertebral border scapula	**rhomboideus** O: occipital crest, C1-T2 I: spine scapula + vertebral border scapula	**rhomboideus** O: occipital crest, C1-T2 I: vertebral border scapula	**rhomboideus** O: occipital crest, C1-T3 I: vertebral border scapula	**rhomboideus** O: occipital crest, C1-T2 I: vertebral border scapula	**r. occipitalis**	**rhomboideus** O: occipital crest, C1-T2 I: vertebral border scapula

	PAUCITUBER CULATA	**NOTORYCTEMORPHIA**		**DASYUROMORPHIA**				
	Caenolestidae	**Notoryctidae**		**Dasyuridae**				**Thylacinidae**
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
RHOMBOIDEUS CERVICIS	**r. major (vertebralis)** O: occipital crest, C-T5 I: vertebral border scapula						**rhomboideus**	
RHOMBOIDEUS THORACIS								
OMOTRANSVERSARIUS "metacromion" ventral	**omo-cleido-transversarius: "atlanto-acromialis"** O: atlas I: metacromion	**omotransversarius** absent			**acromio-trachelien, inferior** O: atlas I: spine scapula + metacromion	**acromio-trachellien inferior** O: atlas I: spine scapula + acromion	**omo-atlantic** O: atlas I: base spine scapula + acromion	**acromio-trachellien** O: atlas I: spine scapula + acromion
OMOTRANSVERSARIUS dorsal	**omo-cleido-transversarius: "atlanto-scapularis"** O: atlas I: spine scapula near cranial angle				**acromio-trachelien, superior** O: atlas I: base spine scapula	**acromio-trachellien superior** O: atlas I: w/ rhomboideus		
OMOHYOIDEUS	**omo-hyoideus** O: hyoid I: cranial angle scapula			**omohyoideus** O: hyoid I: cranial border scapula	**omo-hyoid** O: hyoid I: cranial border scapula			

	PAUCITUBER CULATA	NOTORYCTEMORPHIA		DASYUROMORPHIA				
	Caenolestidae	Notoryctidae		Dasyuridae				Thylacinidae
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
SERRATUS VENTRALIS CERVICIS	**levator scapulae** O: C2-7 I: deep surface vertebral border scapula	**levator-scapulae** O: "small portion from C vertebrae" I: w/ SVT deep surface vertebral border scapula		**levator scapulae** O: w/ SVT				
SERRATUS VENTRALIS THORACIS	**serratus magnus** O: ribs 3-8 I: vertebral border scapula	**serratus anterior** O: ribs 1-5 I: deep surface vertebral border scapula	**serratus magnus (2 parts)** O: C vertebrae, ribs 1-5 // ribs 8-10 I: deep surface vertebral border scapula // caudal angle scapula	**serratus anterior seu magnus** O: C3-7, ribs 1-7 I: vertebral border scapula	**serratus magnus** O: C3-7, ribs 1-7 I: deep surface cranial angle + vertebral border scapula	**serratus magnus** O: C3-7, ribs 1-7 I: vertebral border scapula	**serratus magnus** O: C4-7, ribs I: caudal angle scapula	**serratus magnus** O: C3-7, ribs 1-6 I: vertebral border scapula
CLAVODELTOIDEUS	**acromio-deltoideus** O: acromion + clavicle I: medial deltoid ridge	**deltoideus pars clavicularis** O: lateral clavicle I: distal DP ridge	**cleido-deltoideus** O: lateral clavicle I: proximal DP ridge H	**deltoideus** O: clavicle I: deltoid ridge H	**clavicular deltoid** O: lateral clavicle I: lateral bicipital ridge w/ SD	**deltoid, clavicular portion** O: clavicle + AT I: deltoid ridge H	**deltoid, clavicular** absent	**deltoid, clavicular portion** O: clavicle + AT + CM I: cranio-lateral H w/ PS

	PAUCITUBERCULATA	**NOTORYCTEMORPHIA**		**DASYUROMORPHIA**				
	Caenolestidae	**Notoryctidae**		**Dasyuridae**				**Thylacinidae**
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
ACROMIODELTOIDEUS				**deltoideus** O: acromion I: deltoid ridge H	**acromial deltoid** O: acromion I: lateral bicipital ridge w/ SD	**deltoid, acromial portion** O: acromion I: deltoid ridge H	**deltoid, acromial** O: acromion	
SPINODELTOIDEUS	**spino-deltoideus** O: spine scapula I: distal lateral deltoid ridge	**pars scapularis + pars acromialis** O: acromion, spine scapula, mesoscapular I: proximal lateral DP ridge	**spino- or acromio-deltoid** O: acromion + spine scapula I: proximal DP ridge H	**deltoideus** O: scapula I: deltoid ridge H	**scapulo-spinal deltoid** O: spine scapula, fascia IN I: lateral bicipital ridge w/ AD + CD	**deltoid, scapular portion** O: spine scapula I: deltoid ridge H	**deltoid, scapular** O: spine scapula	**deltoid, scapular portion** O: acromion, spine scapula, fascia IN I: lateral H
TERES MINOR	**teres minor** "weak aponeurosis from infraspinous fossa near the base of the acromion"	**teres minor** absent	**teres minor** absent	**teres minor** O: caudal border scapula I: w/ SD	**teres minor** O: caudal border scapula + metacromion I: GT distal to IN	**teres minor** absent	**teres minor** "not distinct from IN"	**teres minor** O: caudal border scapula near glenoid I: distal GT

	PAUCITUBER CULATA	NOTORYCTEMORPHIA		DASYUROMORPHIA				
	Caenolestidae	**Notoryctidae**		**Dasyuridae**				**Thylacinidae**
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT		**subscapularis** O: subscapular fossa I: LT	**subscapularis** "usual attachments"	**subscapularis** "small"	**subscapularis** "usual attachments"
TERES MAJOR	**teres major** O: caudal angle scapula + SS I: bicipital groove H w/ LD	**teres major** O: hook caudal angle scapula + SS I: distal LT	**teres major** O: caudal angle scapula + SS I: medial bicipital groove H	**teres major** O: caudal angle + border scapula I: medial bicipital groove H w/ LD	**teres major** O: caudal angle + border scapula I: medial bicipital groove H w/ LD	**teres major** O: caudal angle + border scapula I: medial bicipital groove H w/ LD	**teres major**	**teres major** O: caudal angle + border scapula I: w/ LD
LATISSIMUS DORSI	**latissimus dorsi** O: T5-L3, lumbar fascia	**latissimus dorsi - dorso-epitrochlearis** O: T4-10	**latissimus dorsi** O: T3-12	**latissimus dorsi** O: T vertebrae, lumbodorsal fascia	**latissimus dorsi** O: 9T vertebrae, lumbar aponeurosis	**latissimus dorsi** O: T3-lumbar aponeurosis, 1 rib	**latissimus dorsi**	**latissimus dorsi** O: T3-lumbar aponeurosis, 1 rib
"superficial"	I: bicipital groove w/ TMA	I: fascia over elbow + medial forearm	I: fascia over elbow + medial forearm	I: w/ TMA	I: medial bicipital groove H w/ TMA	I: w/ TMA		I: w/ TMA bicipital groove
"deep"				I: bicipital groove H		I: bicipital groove H		-

	PAUCITUBERCULATA	NOTORYCTEMORPHIA		DASYUROMORPHIA				
	Caenolestidae	Notoryctidae		Dasyuridae				Thylacinidae
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
DORSO-EPITROCHLEARIS	**epitrochlearis** O: LD I: olecranon	**latissimus dorsi - dorso-epitrochlearis** fused w/ LD	**dorso-epitrochlearis** fused w/ LD	**latissimocondyloideus seu dorsoepitrochlearis** O: LD I: olecranon	**dorso-epitrochlear** O: LD I: medial olecranon	**dorsi-epitrochlear** O: LD I: medial tip olecranon	**dorsi epitrochlear** O: LD I: medial olecranon	**dorsi-epitrochlear** O: LD I: w/ triceps
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis major** O: sternum I: medial deltoid ridge	**pectoralis superficialis** O: manubrium + sternum I: medial DP ridge H	**pectoralis A** O: sternum + clavicle I: DP tuberosity H	**pectoralis major** O: sternum I: bicipital crest H	**pectoralis major** O: sternum I: proximal lateral bicipital ridge H	**pectoralis major, superficial portion** O: sternum I: lateral bicipital ridge H	**pectoralis major** O: sternum, clavicle, ribs 1-5 I: pectoral ridge H	**pectoralis major** O: sternum I: pectoral ridge H
PECTORALIS SUPERFICIALIS "deep"			**pectoralis B** O: sternum, ribs 2-6 I: DP tuberosity H			**pectoralis major, deep portion** absent		

	PAUCITUBERCULATA	NOTORYCTEMORPHIA		DASYUROMORPHIA				
	Caenolestidae	Notoryctidae		Dasyuridae				Thylacinidae
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
PECTORALIS PROFUNDUS	**pectoralis minor** O: sternum I: LT	**pectoralis descendens** O: ribs 1-5 I: GT + medial neck H	**pectoralis C** O: ribs 2-7	**pectoralis minor** O: sternum, ribs 2-6 I: coracoid + GHj capsule	**pectoralis minor** O: sternum I: GT + GHj capsule, fascia S, coracoid	**pectoralis minor** O: sternum I: GT + GHj capsule, fascia S, coracoid	**pectoralis minor** O: ribs, linea alba, sternum I: head H, GHj capsule, coracoid process	**pectoralis minor** O: sternum + ribs I: GT + tendon of S
PECTORALIS ABDOMINALIS	**humero-abdominalis** O: abdomen I: w/ PC medial deltoid ridge H	**pectoralis transversarius (quartus)** O: slip from abdominal fascia I: w/ PP	**pectoralis quartus** O: slips from abdominal aponeurosis	**pectoralis quartus** O: sternum + linea alba + PC I: bicipital crest H w/ PS	**pectoralis quartus** O: sternum + linea alba I: lateral bicipital ridge H	**pectoralis quartus** O: linea alba + rectus abdominis I: proximal pectoral ridge H w/ PC	**pectoralis quartus** O: lateral chest I: pectoral ridge H	**pectoralis quartus** O: two slips from linea alba I: w/ PS
SUBCLAVIUS	**subclavius** O: rib 1 I: lateral clavicle	**subclavius** O: manubrium I: clavicle, head H, acromion, medial mesoscapular	**subclavius** O: rib 1 I: mesoscapular, acromion	**subclavius** O: rib 1 I: clavicle + acromion	**subclavius** O: rib 1 I: lateral clavicle	**subclavius** O: rib 1 I: lateral clavicle	**subclavius** O: rib 1 I: clavicle	**subclavius** O: rib 1 I: fascia over S
STERNOSCAPULARIS		**costoscapularis** absent						

	PAUCITUBER CULATA	NOTORYCTEMORPHIA		DASYUROMORPHIA				
	Caenolestidae	**Notoryctidae**		**Dasyuridae**				**Thylacinidae**
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
CORACOBRACHIALIS	**coracobrachialis brevis** O: coracoid process I: medial H	**coracobrachialis** absent	**coraco-brachialis** absent	**coracobrachialis** O: coracoid process I: proximal medial H	**coraco-brachialis** O: coracoid I: proximal medial H	**coraco-brachialis brevis** O: coracoid I: proximal medial H	**coraco-brachialis** O: coracoid I: neck H	**coraco-brachialis brevis** O: coracoid I: proximal medial H
CORACOBRACHIALIS						**coraco-brachialis medius** O: coracoid I: middle medial H		
BICEPS BRACHII, short head	**biceps brachii** O: coracoid process I: R + @B U	**biceps brachii** O: glenoid + coracoid I: proximal medial R	**biceps flexor antebrachii** O: glenoid I: R tuberosity	**biceps brachii** O: coracoid I: R tubercle	**biceps, coraco-radial** O: coracoid + glenoid I: R tubercle	**biceps** O: coracoid + glenoid I: R	**biceps** O: coracoid I: R tubercle	**biceps** O: glenoid // coracoid I: U w/ B // R
BICEPS BRACHII, long head				**biceps brachii** O: glenoid I: cornoid process U	**biceps, gleno-ulnar** O: glenoid I: cornoid process U	**biceps** O: glenoid I: U w/ B	**biceps** O: glenoid I: U	(coraco-radial + gleno-ulnar)

	PAUCITUBERCULATA	NOTORYCTEMORPHIA		DASYUROMORPHIA				
	Caenolestidae	Notoryctidae		Dasyuridae				Thylacinidae
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
BRACHIALIS	**brachialis anticus** O: LT + head H I: U	**brachialis** O: proximal lateral H I: coronoid process U	**brachialis anticus s. internus** O: proximal lateral H I: U	**brachialis** O: caudo-lateral H I: coronoid process U	**brachialis anticus** O: caudo-lateral H I: coronoid process U	**brachialis anticus** O: lateral H I: coronoid process U	**brachialis anticus** O: "as usual" I: U	**brachialis anticus** O: caudal H I: coronoid process U
CUBITALIS								
SUPRASPINATUS	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** "3x larger than IN"	**supraspinatus**	**supraspinatus** "2x larger than IN"
INFRASPINATUS	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: lateral GT	**infraspinatus** O: infraspinous fossa I: lateral GT	**infraspinatus**	**infraspinatus**	**infraspinatus**
TRICEPS BRACHII CAPUT LATERALE	**triceps brachii, lateral head** O: near head H I: w/ TLO lateral olecranon		**triceps extensor antibrachii, humeral - outer** O: proximal lateral H I: olecranon	**triceps, lateral head** O: lateral H I: olecranon	**triceps, outer head** O: proximal lateral H I: lateral olecranon w/ TLO	**triceps, external head** I: olecranon		**triceps, external head** O: caudal H I: olecranon

	PAUCITUBERCULATA	NOTORYCTEMORPHIA		DASYUROMORPHIA				
	Caenolestidae	Notoryctidae		Dasyuridae				Thylacinidae
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
TRICEPS BRACHII	**triceps brachii, median head**	**triceps, humeral head**	**triceps extensor antibrachii, humeral - inner**	**triceps, medial head**	**triceps, internal head**	**triceps, internal head**		**triceps, internal head**
CAPUT MEDIALE	O: caudal H I: medial olecranon	O: medial H I: olecranon	O: proximal medial H I: olecranon	O: caudo-medial H I: olecranon	O: distal caudal H I: olecranon w/ TLA, A	"weakly developed" I: olecranon		O: caudo-medial H I: olecranon
TRICEPS BRACHII	**triceps brachii, long head**	**triceps, scapular head**	**triceps extensor antibrachii, scapular**	**triceps, scapular head**	**triceps, middle or long**	**triceps, scapular head**	**triceps longus**	**triceps, scapular head "tendinous origin"**
CAPUT LONGUM	O: caudal border scapula near glenoid	O: caudal border scapula + secondary spine scapula	O: caudal border scapula + secondary spine scapula	O: caudal border scapula	O: caudal border scapula	O: caudal border scapula		O: near glenoid caudal border scapula
"tendon portion" (deep)	I: w/ TLA lateral olecranon	I: lateral olecranon	I: olecranon	I: olecranon	I: lateral olecranon w/ TLA	I: olecranon		I: olecranon
TRICEPS BRACHII								**triceps, scapular head "fleshy origin"**
CAPUT LONGUM								O: caudal border scapula
"fleshy portion" (superficial)								I: w/ TLO
TRICEPS BRACHII ACCESSORY							**subanconeus** O: distal H I: HUj	

	PAUCITUBERCULATA	NOTORYCTEMORPHIA		DASYUROMORPHIA				
	Caenolestidae	Notoryctidae		Dasyuridae				Thylacinidae
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
ANCONEUS		**anconeus lateralis** O: caudal lateral epicondyle I: lateral olecranon	**anconeus externus** O: caudal lateral epicondyle I: lateral olecranon	**anconeus externus** w/ TME	**anconeus externus** O: caudal lateral epicondyle w/ TME I: lateral olecranon + U	**anconeus externus** O: caudal lateral epicondyle I: lateral olecranon + U	**anconeus externus** O: w/ triceps I: proximal U	**anconeus externus** "few fibers" I: lateral olecranon
BRACHIORADIALIS	**brachioradialis** O: lateral supracondylar ridge I: R	**brachioradialis** absent	**supinator longus** absent	**brachioradialis** O: lateral supracondylar ridge I: scaphoid, lunate, digit 2	**supinator longus** O: lateral supracondyloid ridge H I: scapho-lunar	**supinator longus** O: lateral supracondyloid ridge H I: scaphoid	**supinator longus** O: fascia of deltoid I: fascia of digit 1	**supinator longus** O: lateral supracondyloid ridge H I: annular ligament + styloid process R
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis longus** O: lateral supracondylar ridge I: digit 2			**ext carpi radialis** O: lateral supracondylar ridge I: base MC3 + (2)	**ext carpi radialis** O: lateral supracondyloid ridge H I: base MC3	**ext carpi radialis longior et brevior** O: lateral supracondyloid ridge H I: base MC2 + 3	**ext carpi radialis** I: base MC2 + 3	**ext carpi radialis longior** O: lateral supracondyloid ridge H I: base MC2 + 3
EXT CARPI RADIALIS, brevis (MC3)	**ext carpi radialis brevis** O: lateral supracondylar ridge I: digit 3	**ext carpi radialis** O: lateral supracondylar ridge I: base MC3	**ext carpi radialis** O: lateral supracondylar ridge I: base MC3					**ext carpi radialis brevior**

	PAUCITUBERCULATA	NOTORYCTEMORPHIA		DASYUROMORPHIA				
	Caenolestidae	Notoryctidae		Dasyuridae				Thylacinidae
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
EXT DIGITORUM COMMUNIS	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: base MC3+4	**ext communis digitorum** O: lateral epicondyle I: base MC3 + digit 4	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 3, 4, 4, 5
EXT DIGITORUM LATERALIS	**ext digitorum lateralis** O: lateral epicondyle I: digits 4, 5, 5	**ext digiti minimi** absent	**ext minimi digiti** absent	**ext proprius digiti quinti** O: lateral epicondyle I: digits 4, 5	**ext digitorum secundus vel minimi digiti** O: lateral epicondyle I: digits 4, 5	**ext digitorum secundus** O: lateral epicondyle I: digits 4, 5	**ext digitorum secundus** O: lateral epicondyle I: digits 3, 4, 4, 5, 5	**ext digitorum secundus** O: lateral epicondyle I: digits 4, 5
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle + U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: MC5	**ext carpi ulnaris** O: lateral epicondyle I: rudimentary MC5	**ext carpi ulnaris** O: lateral epicondyle + EDL I: base MC5	**ext carpi ulnaris (2 parts)** O: lateral epicondyle I: base MC5 / MC5	**ext carpi ulnaris (2 parts)** O: lateral epicondyle I: unciform / base MC5	**ext carpi ulnaris** O: lateral epicondyle I: MC5	**ext carpi ulnaris (2 parts)** O: lateral epicondyle I: unciform / base MC5
SUPINATOR	**supinator brevis** O: sesamoid at lateral head R I: proximal cranial R	**supinator** O: lateral epicondyle I: proximal lateral R	**supinator radii brevis** O: lateral epicondyle I: proximal lateral R	**supinator brevis** O: lateral epicondyle I: proximal 1/4 R	**supinator brevis** O: lateral epicondyle I: proximal 1/4 R	**supinator brevis** "feebly developed"	**supinator brevis** O: lateral epicondyle I: proximal 1/3 R	**supinator brevis** "feebly developed"

	PAUCITUBERCULATA	NOTORYCTEMORPHIA		DASYUROMORPHIA				
	Caenolestidae	**Notoryctidae**		**Dasyuridae**				**Thylacinidae**
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
ABD POLLICIS LONGUS	**abd pollicis longus** O: U + R I: MC1	**ext pollicis** O: proximal U + R I: base MC1	**ext ossis metacarpi pollicis** O: U + R I: base MC1	**abd pollicis longus vel ext ossis metacarpi pollicis** O: U + R I: base MC1	**ext ossis metacarpi pollicis** O: R + U I: base MC1	**ext ossis metacarpi pollicis** O: R + U I: base MC1 / trapezium	**ext ossis metacarpi pollicis** O: U + interosseus I: trapezium + MC1	**ext ossis metacarpi pollicis (2 parts)** O: R // distal U + R I: base MC1 / trapezium
EXT DIGITORUM PROFUNDUS	**ext indicis** O: U + R I: distal phalanges digits 1 + 2	**ext digitorum II and III** O: lateral olecranon I: digits 2 + 3	**ext indicis et medii digiti proprius** O: U I: digits 2 + 3	**ext digitorum profundus** O: U I: digits 1, 2, 3, 4	**ext indicis + ext medii digiti + ext digiti quarti** O: U I: digits (2), 2, 3, 4	**ext secundi internodii pollicis** O: olecranon + proximal U I: digits 1, 2, 3	**ext indicis** O: distal U I: digits 2, 3, 4	**ext secundi internodii pollicis** O: olecranon + proximal U
EXT POLLICIS LONGUS			**ext secundi internodi pollicis** absent		**ext secundi internodii pollicis** O: lateral olecranon I: digit 1		**ext secundi internodii pollicis** O: distal U I: digit 1	
EXT BREVIS DIGITORUM								
PRONATOR TERES	**pronator teres** O: medial epicondyle I: middle cranial R	**pronator teres** O: medial epicondyle I: distal lateral R	**pronator radii teres** O: medial epicondyle I: distal 1/4 R	**pronator radii teres** O: medial epicondyle I: middle R	**pronator radii teres** O: medial epicondyle I: middle R	**pronator radii teres** O: medial epicondyle I: shaft R	**pronator radii teres** O: medial epicondyle I: middle R	**pronator radii teres** O: medial epicondyle I: middle R

	PAUCITUBER CULATA	NOTORYCTEMORPHIA		DASYUROMORPHIA				
	Caenolestidae	Notoryctidae		Dasyuridae				Thylacinidae
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: base MC2+3	**flx carpi radialis** O: medial epicondyle I: ?	**flx carpi radialis** O: medial epicondyle I: base MC1 + 2	**flx carpi radialis** O: medial epicondyle I: base MC2 + 3	**flx carpi radialis** O: medial epicondyle I: trapezium, base MC1 + 2 + 3	**flx carpi radialis** O: medial epicondyle I: trapezium	**flx carpi radialis** O: medial epicondyle I: MC2 + trapezium	**flx carpi radialis** O: medial epicondyle I: trapezium + base MC1
PALMARIS LONGUS	**palmaris longus** O: medial epicondyle + FCU + FCR I: medial fascia pisiform + transverse ligament + palmar fascia / deep to transverse ligament to digits 2, 3, 4	**palmaris longus** absent	**palmaris longus** absent	**palmaris longus** O: medial epicondyle I: palmar fascia, digits 2, 3, 4, 5	**palmaris longus** O: medial epicondyle + FDP + FCU I: digits 2, 3, 4, 5	**palmaris longus** O: FDP I: palmar fascia	**palmaris longus** O: medial epicondyle I: pad palm of hand	**palmaris longus** O: FDP I: digits 2, 3, 4, 5
FLX DIGITORUM SUPERFICIALIS	**flx digitorum sublimis** O: FDPu (3 heads) I: digits 2, 3, 4	**flx sublimis** absent	**flx sublimis digitorum** absent	**flx digitorum perforatus** O: medial epicondyle I: digits 2, 3, 4, 5	**flexor sublimis** O: FDP I: digits 2, 3, 4, 5		**flx sublimis digitorum** O: medial epicondyle I: digits	

	PAUCITUBERCULATA	NOTORYCTEMORPHIA		DASYUROMORPHIA				
	Caenolestidae	**Notoryctidae**		**Dasyuridae**				**Thylacinidae**
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
INTERFLEXORII								
FLX DIGITORUM PROFUNDUS,	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum**	**flx digitorum communis**	**flx digitorum**	**flx digitorum**	**flx profundus + flx pollicis longus**	**flx digitorum**
epicondylar	O: medial epicondyle						"more or less united"	
epicondylar (FDPe)	O: medial epicondyle	O: medial epicondyle	O: distal medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle		O: medial epicondyle
epicondylar (FDPd)	O: medial sigmoid cavity U	O: medial epicondyle	O: distal medial epicondyle	O: medial epicondyle	O: medial epicondyle			
ulnar	O: medial olecranon + U	O: medial olecranon	O: medial olecranon + proximal U	O: U + R	O: medial olecranon + U	O: medial olecranon + U		O: medial olecranon + U
radial	O: proximal medial R *I: digits 1, 2, 3, 4, 5	O: R *I: sesamoid of palm	O: R I: sesamoid of palm *I: digits 2, 3, 4	*I: digits 1, 2, 3, 4, 5	O: cranial R *I: digits 1, 2, 3, 4, 5	O: cranial R *I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	O: cranial R *I: digits 1, 2, 3, 4, 5

	PAUCITUBER CULATA	NOTORYCTEMORPHIA		DASYUROMORPHIA				
	Caenolestidae	Notoryctidae		Dasyuridae				Thylacinidae
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
LUMBRICALES	**lumbricals** "present but not greatly developed"		**lumbrical slips** absent	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbrical muscles** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbrical muscles** O: FDP I: digits 2, 3, 4, 5
FLX CARPI ULNARIS, **epitrochlear belly** **ulnar belly**	**flexor carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform	**flx carpi ulnaris** O: medial epicondyle I: tip medial olecranon I: pisiform	**flx carpi ulnaris** O: medial epicondyle I: medial olecranon I: pisiform	**flx carpi ulnaris** O: medial epicondyle I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform
EPITROCHLEO-ANCONEUS	**anconeus** O: medial condyle I: medial olecranon	**anconeus medialis** O: caudal medial epicondyle I: medial olecranon	**anconeus internus** O: caudal medial epicondyle I: tip medial olecranon	**anconeus internus** O: caudal medial epicondyle I: olecranon	**anconeus internus** O: caudal medial epicondyle I: medial tip olecranon	**anconeus internus** O: caudal medial epicondyle I: medial tip olecranon	**anconeus internus** present	**anconeus internus** O: caudal medial epicondyle I: medial tip olecranon
PRONATOR QUADRATUS	**pronator quadratus** absent	**pronator quadratus** O: distal 1/2 ridge distal R + U	**pronator quadratus** absent	**pronator quadratus** O: distal 1/2 R + U	**pronator quadratus** O: distal R + U	**pronator quadratus** O: distal 1/3 R+U	**pronator quadratus** O: distal 1/2 R + U	**pronator quadratus** O: distal 1/4 R+U

	PAUCITUBERCULATA	NOTORYCTEMORPHIA		DASYUROMORPHIA				
	Caenolestidae	Notoryctidae		Dasyuridae				Thylacinidae
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
PALMARIS BREVIS				**palmaris brevis** ?	**palmaris brevis** O: hypothenar eminence I: FDS digit 5		**palmaris brevis** O: pisiform I: lost at flx tendons	**palmaris brevis** O: annular ligament I: digit 5
FLX DIGITORUM BREVES MANUS								
ABD DIGITI MINIMI	**abd digiti minimi** O: pisiform I: lateral digit 5			**abd digiti quinti**	**abd minimi digiti** O: pisiform I: digit 5	**abd digiti minimi** O: annular ligament + unciform I: lateral digit 5		**abd digiti minimi** O: pisiform I: digit 5
ABD POLLICIS BREVIS	**abd pollicis** O: trapezium I: medial MC1		**abd pollicis (brevis)** O: annular ligament I: ? digit 1	**abd pollicis**	**abd pollicis** O: annular ligament, sesamoid I: digit 1	**abd pollicis** O: annular ligament, scaphoid, trapezium I: digit 1	**abd pollicis** "moderate size"	**abd pollicis** I: digit 1
CONTRAHENTES	**add indicis, annularis, minimus** O: base MC I: MC2L, MC4M, MC5M			**interosseii palmares** I: 1L, 2L, 4M, 5M	**add pollicis, indicis, annularis, minimi digiti** O: carpus I: 1L, 2L, 4M, 5M	**adductors** O: carpus I: 1L, 2L, 4M, 5M	**palmar interosseus** I: 1L, 2L, 4M, 5M	**adductors** I: 2L, 4M, 5M

	PAUCITUBERCULATA	NOTORYCTEMORPHIA		DASYUROMORPHIA				
	Caenolestidae	Notoryctidae		Dasyuridae				Thylacinidae
	Caenolestes **Osgood, 1921**	***Notoryctes*** **Warburton, 2003**	***Notoryctes*** **Wilson, 1894**	***Dasycercus*** **Jones, 1949**	***Dasyurus*** **MacCormick, 1886**	***Phascogale*** **Cunningham, 1882**	***Sarcophilus*** **Macalister, 1870**	***Thylacinus*** **Cunningham, 1882**
FLEXOR BREVES PROFUNDUS	**short flexors** 9 or 10		**flx brevis pollicis + flx brevis indicis** 3	**flx breves** 10	**flx brevis pollicis, indicis, didigit medii, annularis, minimi digiti** 10	**intermediate group / flx brevis** 10		**intermediate group** 10 + opponens pollicis
INTERMETACARPALES	**abd digiti indicis + dorsal interossei** 4			**interosseii dorsales** 4	**dorsal interossei** 4	**dorsal interossei** 4	**dorsal interossei** 5	**dorsal interossei** 4
? Unknown homology	**flx digitorum sublimis** O: medial epicondyle + U I: FDS				**ventro-humeral** O: linea alba I: w/ PP			
? Unknown homology					**opponens pollicis** O: trapezium I: MC1			
RADIAL SESAMOID "PRE-POLLUX"								
ULNAR SESAMOID								
CARPAL VIBRISSAE								

	DIPROTODONTIA							
	Macropodidae						**Phalangeridae**	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
PANNICULUS CARNOSUS								
STERNO-FACIALIS								
STERNOMASTOIDEUS					**sterno-mastoid** O: paramastoid I: manubrium		**sterno-mastoid** O: occipital crest I: manubrium	
CLEIDOMASTOIDEUS					**cleido-mastoid** O: paramastoid I: middle clavicle		**cleido-mastoid** O: occipital crest I: medial clavicle	**cleido-mastoid** O: mastoid process I: medial clavicle
CLAVOTRAPEZIUS							**cleido-occipital**	**cleido-occipital** O: occipital crest I: medial clavicle

	DIPROTODONTIA							
	Macropodidae						**Phalangeridae**	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
CEPHALOHUMERALIS							**ATa / CD**	**ATa / AD + CD**
ACROMIOTRAPEZIUS	**trapezius pars cervicus** O: nuchal crest, C-T2 vertebrae I: acromion + spine scapula	**trapezius pars cervicalis** O: nuchal crest, C-T2 vertebrae I: lateral clavicle, acromion, spine scapula			**trapezius** O: ligamentum nuchae, T1-6 I: lateral clavicle, acromion, spine scapula		**trapezius** O: occipital crest, C1-T7 I: clavicle, CD, spine scapula	**trapezius** O: occipital crest, C1-T7 I: acromion + spine scapula
DELTOTRAPEZIUS							*	*
DORSO-CUTANEUS								
SPINOTRAPEZIUS	**trapezius pars thoracis** O: T2-T6 I: spine scapula	**trapezius pars thoracica** O: T2-T7 I: spine scapula						
RHOMBOIDEUS CAPITIS	**rhomboideus** O: nuchal crest, C1-T3 I: vertebral border scapula	**rhomboideus** O: nuchal crest, C1-T3 I: vertebral border scapula					**rhomboideus** O: occipital crest, C1-T3 I: vertebral border scapula	**rhomboideus** O: occipital crest, C1-T2 I: vertebral border scapula

	DIPROTODONTIA							
	Macropodidae						**Phalangeridae**	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
RHOMBOIDEUS CERVICIS					**rhomboid** O: ligamentum nuchae, T1-3 I: vertebral border scapula			
RHOMBOIDEUS THORACIS								
OMOTRANSVERSARIUS "metacromion" ventral	**omotransversarius** O: atlas I: acromion + spine scapula	**omotransversarius** O: atlas I: acromion + spine scapula			**acromio-trachelien** O: C1-4 I: acromion + spine scapula		**omo-atlantic** O: atlas I: spine scapula	**acromio-trachellien superior** O: atlas + axis I: w/ OT spine scapula + acromion
OMOTRANSVERSARIUS dorsal	**atlantoscapularis** O: atlas I: vertebral border + spine scapula	**serratus ventralis cervicis (atlantoscapularis)** O: atlas I: vertebral border + spine scapula			**levator anguli scapulae** O: atlas I: spine scapula		**omo-atlantic** O: atlas I: base spine scapula	**acromio-trachellien inferior** O: atlas I: w/ OT spine scapula + acromion
OMOHYOIDEUS					**omo-hyoid** O: hyoid I: scapula		**omo-hyoid** O: hyoid	

	DIPROTODONTIA							
	Macropodidae						**Phalangeridae**	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
SERRATUS VENTRALIS CERVICIS	**levator scapulae** O: T3-5 I: cranial angle scapula	**serratus ventralis cervicis (levator scapulae)** O: C3-T1, rib 1 I: cranial border scapula			**levator anguli scapulae** O: w/ SVT		**levator anguli scapulae** O: atlas I: supraspinous fossa	
SERRATUS VENTRALIS THORACIS	**serratus ventralis** O: ribs 1-6, T6-7 I: vertebral border scapula	**serratus ventralis thoracis** O: ribs 2-6 I: deep surface vertebral border scapula			**serratus magnus** O: C1-7, ribs 1-7 I: vertebral border scapula		**serratus magnus** O: C2-7, ribs 2-7 I: deep surface scapula	**serratus magnus** O: C3-7, ribs 1-8 I: vertebral border scapula
CLAVODELTOIDEUS	**deltoideus pars clavicularis** O: middle clavicle I: proximal cranial H near GT w/ PS	**deltoideus pars clavicularis** O: lateral clavicle I: deltoid crest H	**deltoideus, clavodeltoid** O: lateral clavicle I: deltoid tuberosity H				**deltoid** O: clavicle, acromion, spine scapula I: pectoral crest	**deltoid, clavicular portion** O: middle clavicle + AT I: proximal deltoid ridge

	DIPROTODONTIA							
	Macropodidae						**Phalangeridae**	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
ACROMIODELTOIDEUS	**deltoideus pars acromialis** O: acromion I: distal DP ridge H	**deltoideus pars acromialis** O: acromion I: w/ SD lateral deltoid crest H	**deltoideus, acromio-spinodeltoid** O: acromion, spine scapula I: deltoid tuberosity H					
SPINODELTOIDEUS	**deltoideus pars spinalis** O: spine scapula + fascia IN I: DP ridge H	**deltoideus pars spinalis** O: spine scapula + fascia IN I: w/ AD lateral deltoid crest H			**deltoid (fused)** O: clavicle, acromion, spine scapula I: proximal H			**deltoid, scapular portion** O: AT, acromion, spine scapula, fascia IN I: lateral deltoid ridge
TERES MINOR	**teres minor** O: caudal border scapula I: base GT	**teres minor** O: caudal border scapula near glenoid I: lateral neck H	**teres minor** O: caudal border scapula I: neck of H distal to IN		**teres minor** "easily separable from IN"		**teres minor** "thin and muscular"	**teres minor** O: caudal border scapula near glenoid I: distal GT

	DIPROTODONTIA							
	Macropodidae						**Phalangeridae**	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT				**subscapularis**	**subscapularis** "usual attachments"
TERES MAJOR	**teres major**	**teres major** O: caudal angle + border scapula I: proximal medial H w/ LD	**teres major** O: caudal angle + border scapula I: teres tuberosity H w/ LD		**teres major** "normal" I: w/ LD		**teres major**	**teres major** O: caudal angle + border scapula I: w/ LD medial bicipital groove H
LATISSIMUS DORSI	**latissimus dorsi** O: T12-thoracolumbar fascia, rib 12	**latissimus dorsi** O: dorsal midline, ribs 1-7			**latissimus dorsi** O: T5-8, ribs 9-11		**latissimus dorsi** O: T4-12, rib 12	**latissimus dorsi** O: T3-lumbar aponeurosis, 1 rib
"superficial"	I: proximal medial H	I: proximal medial H			I: H		I: H w/ TMA	I: w/ TMA
"deep"								I: bicipital groove H

	DIPROTODONTIA							
	Macropodidae						**Phalangeridae**	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
DORSO-EPITROCHLEARIS	**tensor fasciae antebrachii** O: LD I: medial olecranon + triceps, forearm fascia	**tensor fasciae antebrachii** O: LD I: TLO near olecranon	**tensor fasciae antebrachii** O: LD I: medial olecranon + forearm fascia		**dorso-epitrochlearis** "small" I: "does not quite reach olecranon"		**dorso-epitrochlearis** O: LD I: olecranon	**dorsi-epitrochlear** O: LD I: medial tip olecranon
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis superficialis** O: manubrium, ribs I: medial clavicle, pectoral ridge H, w/ CD	**pectoralis superficialis (descending)** O: manubrium + sternum I: proximal pectoral crest H			**pectoral (a)** O: sternum + medial clavicle I: middle H w/ deltoid		**pectoralis major** O: sternum I: pectoral crest H w/ CD	**pectoralis major, superficial portion** O: sternum I: lateral bicipital groove H
PECTORALIS SUPERFICIALIS "deep"		**pectoralis superficialis (transverse)** O: rib 1 + manubrium I: proximal pectoral crest H			**pectoral (y)** O: rib 1 I: proximal pectoral ridge H		**pectoralis major, deep part** O: sternum + manubrium I: GT + proximal pectoral crest H	**pectoralis major, deep portion** O: sternum I: GT + lateral bicipital groove H

	DIPROTODONTIA							
	Macropodidae						Phalangeridae	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
PECTORALIS PROFUNDUS	**pectoralis minor** O: clavicle, ribs 2-3 I: proximal pectoral ridge, GT, clavicle	**pectoralis profundis** O: ribs 3-6 I: middle pectoral crest H			**pectoral (ß)** O: ribs 2-3 I: proximal pectoral ridge H		**pectoralis minor** O: sternum I: GT + coracoid	**pectoralis minor** O: sternum I: GT + GHj capsule, fascia S, coracoid
PECTORALIS ABDOMINALIS	**pectoralis quartus** O: ribs 3-6 I: pectoral ridge H	**pectoralis quartus** O: lateral thorax I: w/ PSs			**pectoral (δ)** O: linea alba I: proximal pectoral ridge H w/ PC			**pectoralis quartus** O: linea alba + rectus abdominis I: proximal pectoral ridge H w/ PC
SUBCLAVIUS	**subclavius** O: rib 1, manubrium I: medial clavicle				**subclavius** O: "usual" I: clavicle		**subclavius** I: lateral clavicle	**subclavius** O: rib 1 I: lateral clavicle
STERNOSCAPULARIS								

	DIPROTODONTIA							
	Macropodidae						**Phalangeridae**	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
CORACOBRACHIALIS	**coracobrachialis** O: coracoid process I: distal medial LT	**coracobrachialis** O: coracoid process I: medial H	**coracobrachialis** O: coracoid process I: medial neck H + crest LT		**coraco-brachialis**		**coraco-brachialis** O: coracoid I: proximal medial H	**coraco-brachialis brevis** O: coracoid I: proximal medial H
CORACOBRACHIALIS							**coraco-brachialis** O: coracoid I: supracondyloid foramen H	**coraco-brachialis longus** O: coracoid I: supracondyloid foramen H
BICEPS BRACHII, short head	**biceps brachii** O: coracoid process I: R	**biceps brachii** O: coracoid process I: R	**biceps brachii "coraco-radial"** O: coracoid process I: R		**biceps** O: coracoid I: R + U		**biceps (splits)** O: coracoid + glenoid I: R tuberosity + U	**biceps** O: coracoid + glenoid I: R
BICEPS BRACHII, long head	**biceps brachii** O: coracoid process I: U w/ B	**biceps brachii** O: supraglenoid tubercle I: U w/ B	**biceps brachii "gleno-ulnarl"** O: glenoid I: U					**biceps** O: glenoid I: U w/ B

	DIPROTODONTIA							
	Macropodidae						**Phalangeridae**	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
BRACHIALIS	**brachialis** O: lateral H I: U	**brachialis** O: lateral H I: U	**brachialis** O: neck H + lateral H I: coronoid process U		**brachialis anticus** O: neck H + lateral H I: U w/ BB		**brachialis anticus** O: lateral H I: U	**brachialis anticus** O: lateral H I: coronoid process U
CUBITALIS								
SUPRASPINATUS	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: cranio-lateral GT		**supraspinatus** "smaller than IN"		**supraspinatus** "larger than IN"	**supraspinatus** "larger than IN"
INFRASPINATUS	**infraspinatus** O: infraspinous fossa I: lateral GT	**infraspinatus** O: infraspinous fossa I: lateral GT	**infraspinatus** O: infraspinous fossa I: distal GT		**infraspinatus**		**infraspinatus**	**infraspinatus**
TRICEPS BRACHII	**triceps brachii caput lateral**	**triceps brachii caput lateral**	**triceps brachii, lateral head**		**triceps**		**triceps, humeral heads**	**triceps, external head**
CAPUT LATERALE	O: caudo-lateral H I: lateral olecranon	O: distal to GT I: olecranon	O: caudo-lateral H I: olecranon		"large and has the human attachments"		"fused"	 I: olecranon

	DIPROTODONTIA							
	Macropodidae						**Phalangeridae**	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
TRICEPS BRACHII CAPUT MEDIALE	**triceps brachii caput medial** O: distal medial H I: medial olecranon	**triceps brachii caput medial** O: medial H I: olecranon	**triceps brachii, medial head** O: caudal H I: olecranon					**triceps, internal head** "weakly developed" I: olecranon
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps brachii caput longum** O: caudal border scapula I: olecranon	**triceps brachii caput longum** O: caudal border scapula I: olecranon	**triceps brachii, long head** O: caudal border scapula I: olecranon				**triceps, long head** O: caudal border scapula	**triceps, scapular head** O: caudal border scapula I: olecranon
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)								
TRICEPS BRACHII ACCESSORY								

	DIPROTODONTIA							
	Macropodidae						Phalangeridae	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
ANCONEUS	**anconeus** ? ?	**anconeus, lateral** O: caudal lateral epicondyle I: lateral olecranon	**anconeus** O: caudal lateral epicondyle I: lateral U		**anconeus** "well marked and normal"		**anconeus externus** present	**anconeus externus** O: caudal lateral epicondyle I: lateral olecranon + U
BRACHIORADIALIS	**brachioradialis** O: supinator ridge H I: MC1	**brachioradialis** O: supinator ridge H I: radial carpus	**brachioradialis** O: lateral supracondyloid ridge H I: radial carpus, annular ligament		**supinator longus** I: scaphoid		**supinator longus** O: lateral supracondyloid ridge H	**supinator longus** O: lateral supracondyloid ridge H I: scaphoid
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis** O: supinator ridge H + lateral R I: MC2 + 3	**ext carpi radialis longus** O: supinator ridge H I: MC2	**ext carpi radialis** O: lateral supracondyloid ridge H I: MC2 + 3		**ext carpi radialis longior et brevior** "present and normal" I: MC2		**ext carpi radiales** O: lateral epicondyle I: MC2	**ext carpi radialis longior** O: lateral supracondyloid ridge H I: base MC2
EXT CARPI RADIALIS, brevis (MC3)		**ext carpi radialis brevis** O: supinator ridge H I: MC3			"separate" I: MC3		**ext carpi radiales** O: lateral epicondyle I: MC3	**ext carpi radialis brevior** O: lateral supracondyloid ridge H, P, R I: base MC3

	DIPROTODONTIA							
	Macropodidae						Phalangeridae	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
EXT DIGITORUM COMMUNIS	**ext digitorum communis** O: lateral epicondyle I: digits 3, 4, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 3, 4, 5		**ext communis digitorum** "normal" I: digits 2, 3, 4, 5		**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5
EXT DIGITORUM LATERALIS		**ext digitorum lateralis** O: lateral epicondyle I: digits 4, 5	**ext digitorum lateralis** O: lateral epicondyle I: digits 4, 5		**ext minimi digiti** I: digits 4, 5		**ext secundus digitorum** I: digits 4, 5	**ext digitorum secundus** O: lateral epicondyle I: digits 4, 5
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle + U I: pisiform	**ext carpi ulnaris** O: lateral epicondyle I: pisiform + MC5	**ulnaris lateralis** O: lateral epicondyle I: MC5		**ext carpi ulnaris** "usual human attachments"		**ext carpi ulnaris** O: lateral epicondyle I: MC5	**ext carpi ulnaris** O: lateral epicondyle I: MC5
SUPINATOR	**supinator** O: lateral epicondyle I: proximal 1/3 medial R	**supinator** O: lateral epicondyle I: proximal 1/3 medial R	**supinator** O: lateral epicondyle I: proximal 1/4 cranial R		**supinator brevis** I: proximal 1/4 R		**supinator brevis** I: proximal 1/5 R	**supinator brevis** "feebly developed" I: proximal R

	DIPROTODONTIA							
	Macropodidae						Phalangeridae	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
ABD POLLICIS LONGUS	**ext ossis metacarpus pollicus** O: R + U I: base MC1	**abd pollicis longus** O: proximal R + U I: base MC1	**abd digiti I longus** O: proximal lateral U + R I: medial MC1		**ext ossis metacarpi pollicis** O: U + R I: "usual"		**ext ossis metacarpi pollicis** O: U + R	**ext ossis metacarpi pollicis** O: R + U I: base MC1 // trapezium
EXT DIGITORUM PROFUNDUS	**ext digitorum communis** O: w/ EDC I: digits 1, 2		**ext digiti I, II et III** O: proximal lateral U I: digits 1, 2, 3		**ext secundi internodii and ext indicis** I: digits 1, 2, 3			**ext secundi internodii pollicis (2 parts)** O: olecranon + proximal U I: digit 1
EXT POLLICIS LONGUS					**ext primi internodii pollicis** absent			**ext medii** O: U I: digit 3
EXT BREVIS DIGITORUM								
PRONATOR TERES	**pronator teres** O: medial epicondyle I: cranio-medial R	**pronator teres** O: medial epicondyle I: medial R	**pronator teres** O: medial epicondyle I: medial R		**pronator radii teres** O: medial epicondyle I: middle R		**pronator radii teres** O: medial epicondyle I: distal 2/3 R	**pronator radii teres** O: medial epicondyle I: shaft R

	DIPROTODONTIA							
	Macropodidae						Phalangeridae	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: scaphoid	**flx carpi radialis** O: medial epicondyle I: scaphoid	**flx carpi radialis** O: medial epicondyle I: radial carpus, MC1 + 2		**flx carpi radialis** "normal"		**flx carpi radialis** I: base MC2	**flx carpi radialis** O: medial epicondyle I: base MC2 + 3
PALMARIS LONGUS	**palmaris longus** O: medial epicondyle I: fascia carpus	**palmaris longus** O: medial epicondyle I: palmar fascia	**palmaris longus** O: medial epicondyle I: metacarpal pad		**palmaris longus** I: palmar fascia		**palmaris longus** present	**palmaris longus** O: medial epicondyle + FDP I: palmar fascia
FLX DIGITORUM SUPERFICIALIS	**flx digitorum superficialis** O: distal medial epicondyle w/ FDP I: tendons FDP	**flx digitorum superficialis** O: FDP I: digits 2, 3, 4	**flx digitorum superficialis** O: FDP I: digits 2, 3, 4		**flx sublimis digitorum** O: FDP I: digits 2, 3, 4		**flx sublimis digitorum** O: FDP	**flx sublimis** O: FDP mass I: digits 2, 3, 4, 5

	DIPROTODONTIA							
	Macropodidae						**Phalangeridae**	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
INTERFLEXORII								
FLX DIGITORUM PROFUNDUS,	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**		**flx profundus digitorum**			**flx digitorum**
epicondylar								
epicondylar (FDPe)	O: distal medial epicondyle w/ FDS	O: medial epicondyle	O: medial epicondyle		O: medial epicondyle			O: medial epicondyle
epicondylar (FDPd)								
ulnar	O: proximal medial U	O: proximal medial U	O: medial olecranon + U		O: medial olecranon + proximal U			O: medial olecranon + U
radial	O: proximal medial R	O: proximal medial R	O: cranial R		O: proximal R			O: cranial R
	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5		*I: digits 1, 2, 3, 4, 5			*I: digits 1, 2, 3, 4, 5

	DIPROTODONTIA							
	Macropodidae						Phalangeridae	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
LUMBRICALES			**lumbricales**	**lumbricales** O: FDP I: digits 1, 2, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4			**lumbrical muscles** O: FDP I: digits 2, 3, 4, 5
FLX CARPI ULNARIS, **epitrochlear belly** **ulnar belly**	**flx carpi ulnaris** O: medial epicondyle O: medial U I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: medial U I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: medial U I: pisiform, MC5		**flx carpi ulnaris** O: medial epicondyle O: medial U I: pisiform, sesamoid		**flx carpi ulnaris** I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform
EPITROCHLEO-ANCONEUS		**anconeus, medial** O: medial epicondyle I: medial olecranon			**epitrochleo-anconeus** "well marked and normal"		**anconeus internus** O: medial epicondyle I: olecranon	**anconeus internus** O: caudal medial epicondyle I: medial tip olecranon
PRONATOR QUADRATUS		**pronator quadratus** O: distal 1/3 R + U	**pronator quadratus** O: distal 2/3 R + U		**pronator quadratus** O: distal 2/3 R + U		**pronator quadratus** O: distal 1/6 R + U	**pronator quadratus** O: distal 1/3 R+U

	DIPROTODONTIA							
	Macropodidae						**Phalangeridae**	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
PALMARIS BREVIS					**palmaris brevis** "large"			
FLX DIGITORUM BREVES MANUS								
ABD DIGITI MINIMI			**abd digit V**	**abd minimi digiti** O: annular ligament + ulnar sesamoid I: digit 5	**abd minimi digiti** O: palmar fascia I: digit 5	**abd minimi digiti** O: annular ligament + ulnar sesamoid I: digit 5		**abd digiti minimi** I: digit 5
ABD POLLICIS BREVIS			**abd digit I**	**abd pollicis** O: radial sesamoid, annular ligament I: digit 1 + sesamoid	**abd brevis pollicis**	**abd pollicis** O: radial sesamoid, annular ligament I: digit 1 + sesamoid		**abd pollicis** I: digit 1
CONTRAHENTES			**add digit I, add digit V**	**palmar group** O: MC3 I: 1L, 2L, 4M, 5M	**superficial intrinsic**	**palmar group** O: MC3 I: 1L, 2L, 4M, 5M		**adductors** O: MC3 I: 1L, 2L, 4M, 5M

	DIPROTODONTIA							
	Macropodidae						**Phalangeridae**	
	Dendrolagus **Warburton, 2011**	***Macropus*** **Harvey & Warburton, 2010**	***Macropus*** **Hopwood, 1974**	***Petrogale*** **Young, 1880**	***Petrogale*** **Parsons, 1896b**	***Wallabia*** **Young, 1880**	***Phalanger*** **Sonntag, 1922b**	***Spilocuscus*** **Cunningham, 1882**
FLEXOR BREVES PROFUNDUS			**interossei**	**intermediate group** "less differentiated"	**intermediate intrinsic**	**intermediate group** ?		**intermediate group** 10 + opponens minimi digiti
INTERMETACARPALES			**interossei**	**dorsal interossei** 4	**deep intrinsic**	**dorsal interossei** 4		**dorsal interossei** 4
? Unknown homology				**opponens pollicis** w/ APB	**opp pollicis** absent	**opponens pollicis** w/ APB		
? Unknown homology				**opponens minimi digiti** O: unciform + annular ligament I: lateral MC5	**opp of the little finger** O: pisiform I: digit 5	**opponens minimi digiti** O: unciform + annular ligament I: lateral MC5		
RADIAL SESAMOID "PRE-POLLUX"								
ULNAR SESAMOID								
CARPAL VIBRISSAE								

	DIPROTODONTIA continued					
	Pseudocheiridae	**Phascolarctidae**		**Vombatidae**		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
PANNICULUS CARNOSUS			**panniculus carnosus** O: trunk I: H	**panniculus carnosus** "weak and undefined"		
STERNO-FACIALIS						
STERNOMASTOIDEUS	**sterno-mastoid** O: occipital crest I: manubrium	**sterno-mastoid** O: occipital crest I: manubrium	**sterno-mastoid** O: lateral occipital crest I: manubrium		**sterno-mastoid** O: occipital crest I: manubrium	
CLEIDOMASTOIDEUS	**cleido-mastoid** O: occipital crest I: medial clavicle	**cleido-mastoid** O: occipital crest I: medial clavicle	**cleido-mastoid** O: occipital crest I: medial clavicle		**cleido-mastoid** O: occipital crest I: medial clavicle	
CLAVOTRAPEZIUS	**cleido-occipital**	**cleido-occipital** absent	**cleido-mastoid, small slip of fibres** O: trapezius I: clavicle		**cleido-occipital** absent	

	DIPROTODONTIA continued					
	Pseudocheiridae	**Phascolarctidae**		**Vombatidae**		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
CEPHALOHUMERALIS	**ATa / CD**	**ATa / CD**			**ATa / CD**	
ACROMIOTRAPEZIUS	**trapezius** O: occipital crest, C1-T7 I: clavicle, CD, spine scapula	**trapezius** O: occipital crest, C1-T7 I: clavicle, CD, spine scapula	**trapezius** O: occipital crest, C1-T8 I: acromion + spine scapula	**trapezius** O: occipital crest, C1-T7 I: acromion + spine scapula	**trapezius** O: occipital crest, C1-T7 I: clavicle, CD, spine scapula	
DELTOTRAPEZIUS	*	*	*	*	*	
DORSO-CUTANEUS						
SPINOTRAPEZIUS						
RHOMBOIDEUS CAPITIS	**rhomboideus** O: occipital crest, C1-T3 I: vertebral border scapula	**rhomboideus** O: occipital crest, C1-T3 I: vertebral border scapula	**rhomboideus** O: occipital crest, C1-T3 I: vertebral border scapula	**rhomboideus** O: occipital crest, C1-T5 I: vertebral border scapula	**rhomboideus** O: occipital crest, C1-T5 I: vertebral border scapula	

	DIPROTODONTIA continued					
	Pseudocheiridae	**Phascolarctidae**		**Vombatidae**		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
RHOMBOIDEUS CERVICIS						
RHOMBOIDEUS THORACIS						
OMOTRANSVERSARIUS "metacromion" ventral	**omo-atlantic** O: atlas I: spine scapula	**omo-atlantic** O: atlas I: spine scapula		**omo-atlantic** O: atlas + axis I: base spine scapula, acromion	**omo-atlantic** O: atlas I: spine scapula	
OMOTRANSVERSARIUS dorsal	**omo-atlantic** O: atlas I: base spine scapula				**omo-atlantic** O: atlas I: base spine scapula	
OMOHYOIDEUS	**omo-hyoid** O: hyoid	**omo-hyoid** O: tongue	**omo-hyoid** O: mandible I: cranial border scapula		**omo-hyoid** O: hyoid	

	DIPROTODONTIA continued					
	Pseudocheiridae	Phascolarctidae		Vombatidae		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
SERRATUS VENTRALIS CERVICIS	**levator anguli scapulae** O: w/ SVT	**levator anguli scapulae** O: atlas I: spine scapula	**levator scapulae** O: atlas w/ SVT I: acromion + spine scapula	**levator scapulae** O: C4-7, ribs 1-3 I: spine scapula	**levator anguli scapulae** O: atlas I: base spine scapula	
SERRATUS VENTRALIS THORACIS	**serratus magnus** O: ribs 1-8 I: deep surface scapula	**serratus magnus** O: C2-7, ribs 1-9 I: deep surface scapula	**serratus magnus** O: C2-7, ribs 1-9	**serratus magnus** O: ribs 5-11 I: caudal angle scapula	**serratus magnus** I: deep surface scapula	
CLAVODELTOIDEUS	**deltoid** O: clavicle, acromion, spine scapula I: pectoral crest	**deltoid** O: clavicle, acromion, spine scapula I: pectoral crest, slip to forearm	**deltoid, clavicular portion** O: lateral clavicle I: distal DP ridge H w/ SD	**deltoid, clavicular** O: AT I: deltoid crest H	**deltoid** O: clavicle, acromion, spine scapula I: pectoral crest	

	DIPROTODONTIA continued					
	Pseudocheiridae	Phascolarctidae		Vombatidae		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
ACROMIODELTOIDEUS						
SPINODELTOIDEUS			**deltoid, scapular moiety** O: acromion, spine scapula I: distal DP ridge H w/ AD	**deltoid, scapular** O: acromion, spine scapula I: deltoid crest H		
TERES MINOR	**teres minor** "thin and muscular"	**teres minor** "thin w/ tendinous attachment"	**teres minor** "small but usual attachments"	**teres minor** "not distinct from IN"	**teres minor** "fascial"	

	DIPROTODONTIA continued					
	Pseudocheiridae	**Phascolarctidae**		**Vombatidae**		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
SUBSCAPULARIS	**subscapularis**	**subscapularis**	**subscapularis** O: subscapular fossa I: LT + GHj capsule	**subscapularis** "no features of interest"	**subscapularis**	
TERES MAJOR	**teres major**	**teres major**	**teres major** O: caudal border scapula I: H near LD	**teres major** O: caudal border scapula	**teres major**	
LATISSIMUS DORSI	**latissimus dorsi** O: T4-12	**latissimus dorsi** O: T4-10	**latissimus dorsi** O: 6T	**latissimus dorsi** O: T4-15, ribs 9-15, lumbar aponeurosis	**latissimus dorsi** O: T5-15, ribs 9-12	
"superficial"	I: H w/ TMA	I: H w/ TMA	I: H	I: w/ TMA H	I: H w/ TMA	
"deep"						

	DIPROTODONTIA continued					
	Pseudocheiridae	**Phascolarctidae**		**Vombatidae**		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
DORSO-EPITROCHLEARIS	**dorso-epitrochlearis** O: LD I: olecranon	**dorso-epitrochlearis** O: LD I: olecranon	**dorso-epitrochlearis** O: LD I: olecranon	**dorsi epitrochlear** O: LD I: medial olecranon	**dorso-epitrochlearis** O: LD I: olecranon	
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis major** O: sternum I: pectoral crest H w/ CD	**pectoralis major** O: medial clavicle + sternum I: pectoral crest H w/ CD	**pectoralis major** O: sternum I: DP ridge H	**pectoralis major** O: sternum, clavicle, ribs 1-6 I: pectoral ridge H	**pectoralis major** O: sternum I: pectoral crest H w/ CD	
PECTORALIS SUPERFICIALIS "deep"	**pectoralis major, deep part** O: manubrium + sternum I: GT + proximal pectoral crest H	**pectoralis major, deep part** O: manubrium I: GT + proximal pectoral crest H	**pectoralis minimus** O: ribs 1-2 I: GT	**pectoralis major** O: manubrium + rib 1 I: head H	**pectoralis major, deep part** O: manubrium I: GT + proximal pectoral crest H	

	DIPROTODONTIA continued					
	Pseudocheiridae	**Phascolarctidae**		**Vombatidae**		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
PECTORALIS PROFUNDUS	**pectoralis minor** O: sternum I: GT + coracoid	**pectoralis minor** O: sternum I: GT + coracoid	**pectoralis minor** O: ribs 3-5 I: GT + GHj capsule	**pectoralis minor** O: sternum I: lateral GT + coracoid process	**pectoralis minor** O: sternum I: GT + coracoid	
PECTORALIS ABDOMINALIS			**pectoralis quartus** O: abdominal aponeurosis I: H w/ PC	**pectoralis quartus** O: lateral chest I: pectoral ridge H		
SUBCLAVIUS	**subclavius** I: lateral clavicle	**subclavius** I: lateral clavicle	**subclavius** "ordinary attachments"	**subclavius** O: rib 1 I: lateral clavicle, acromion, spine scapula	**subclavius** I: lateral clavicle, acromion, spine scapula	
STERNOSCAPULARIS						

	DIPROTODONTIA continued					
	Pseudocheiridae	**Phascolarctidae**		**Vombatidae**		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
CORACOBRACHIALIS	**coraco-brachialis** O: coracoid I: proximal medial H	**coraco-brachialis** O: coracoid I: proximal medial H	**coraco-brachialis brevis vel superioris** O: coracoid process I: medial H	**coraco-brachialis** O: coracoid I: distal to LT	**coraco-brachialis** O: coracoid I: proximal medial H	
CORACOBRACHIALIS	**coraco-brachialis** O: coracoid I: supracondyloid foramen H	**coraco-brachialis** O: coracoid I: supracondyloid foramen H	**coraco-brachialis** O: coracoid process I: medial H to medial epicondyle		**coraco-brachialis** O: coracoid I: supracondyloid foramen H	
BICEPS BRACHII, short head	**biceps, coraco-radial** O: coracoid I: R tuberosity	**biceps (splits)** O: coracoid + glenoid I: R tuberosity + U	**biceps (coraco-radial)** O: coracoid + glenoid I: R tubercle	**biceps** O: coracoid I: R tubercle	**biceps (splits)** O: coracoid + glenoid I: R tuberosity + U	
BICEPS BRACHII, long head	**biceps, gleno-ulnar** O: glenoid I: U		**biceps (gleno-ulnar)** O: coracoid + glenoid I: U	**biceps** O: glenoid I: U		

	DIPROTODONTIA continued					
	Pseudocheiridae	**Phascolarctidae**		**Vombatidae**		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
BRACHIALIS	**brachialis anticus** O: lateral H I: U	**brachialis anticus** O: lateral H I: U w/ BB	**brachialis anticus** O: lateral H I: U w/ BB	**brachialis anticus** O: "as usual" I: U	**brachialis anticus** O: lateral H I: U	
CUBITALIS						
SUPRASPINATUS	**supraspinatus** "larger than IN"	**supraspinatus** "smaller than IN"	**supraspinatus** "smaller than IN"	**supraspinatus** "larger than IN"	**supraspinatus** "larger than IN"	
INFRASPINATUS	**infraspinatus**	**infraspinatus**	**infraspinatus** "nothing unusual"	**infraspinatus**	**infraspinatus**	
TRICEPS BRACHII	**triceps, humeral heads**	**triceps, humeral heads**	**triceps, external**	**triceps, lateral heads**	**triceps, humeral heads**	
CAPUT LATERALE	"fused"	"fused"	O: caudal H	"united"	"fused"	

	DIPROTODONTIA continued					
	Pseudocheiridae	**Phascolarctidae**		**Vombatidae**		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
TRICEPS BRACHII CAPUT MEDIALE			**triceps, internal** O: caudal H			
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps, long head** O: caudal border scapula	**triceps, long head** O: caudal border scapula	**triceps, scapular** O: caudal border scapula	**triceps longus** O: caudal border scapula	**triceps, long head** O: caudal border scapula	
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)						
TRICEPS BRACHII ACCESSORY				**subanconeus** absent		

	DIPROTODONTIA continued					
	Pseudocheiridae	Phascolarctidae		Vombatidae		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
ANCONEUS	**anconeus externus** present	**anconeus externus** present	**anconei, external** O: lateral epicondyle I: lateral olecranon	**anconeus externus** "distinct"	**anconeus externus** present	
BRACHIORADIALIS	**supinator longus** O: lateral supracondyloid ridge H	**supinator longus** O: neck+ lateral supracondylar ridge H I: scapho-lunar	**supinator longus** O: lateral H I: scapho-lunar	**supinator longus** "fascial and thin"	**supinator longus**	
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radiales**	**ext carpi radiales** O: lateral epicondyle I: MC2	**ext carpi radialis longior** O: supinator ridge H I: MC2	**ext carpi radialis** I: base MC2 + 3	**ext carpi radiales** O: lateral epicondyle I: MC2 + 3	
EXT CARPI RADIALIS, brevis (MC3)		**ext carpi radiales** O: lateral epicondyle I: MC3	**ext carpi radialis brevior** O: lateral epicondyle I: MC3			

	DIPROTODONTIA continued					
	Pseudocheiridae	**Phascolarctidae**		**Vombatidae**		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
EXT DIGITORUM COMMUNIS	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 1, 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 1, 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5	
EXT DIGITORUM LATERALIS	**ext secundus digitorum** I: digits 4, 5	**ext secundus digitorum** I: digits 3, 4, 5	**ext secundus digitorum** O: U I: digits 3, 4, 5	**ext digitorum secundus** O: lateral epicondyle I: digits 4, 5	**ext secundus digitorum** I: digits 4, 5	
EXT CARPI ULNARIS	**ext carpi ulnaris**	* doubled **ext carpi ulnaris** O: U + lateral epicondyle I: MC5	* doubled **ext carpi ulnaris** O: U + lateral epicondyle I: base MC5	**ext carpi ulnaris** O: U + lateral epicondyle I: MC5	**ext carpi ulnaris** O: U + lateral epicondyle I: MC5	
SUPINATOR	**supinator brevis**	**supinator brevis** I: proximal 1/5 R	**supinator brevis** "no ulnar attachment"	**supinator brevis** O: lateral epicondyle I: proximal 2/3 R	**supinator brevis** I: proximal 2/3 R	

	DIPROTODONTIA continued					
	Pseudocheiridae	**Phascolarctidae**		**Vombatidae**		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
ABD POLLICIS LONGUS	**ext ossis metacarpi pollicis** O: U + R	**ext ossis metacarpi pollicis** O: proximal U + R	**ext ossis metacarpi pollicis** O: R + interosseus I: trapezium + MC1	**ext ossis metacarpi pollicis** O: U + interosseus I: trapezium + MC1	**ext ossis metacarpi pollicis** O: U I: trapezium + MC1	
EXT DIGITORUM PROFUNDUS			**ext indicis** absent	**ext indicis** absent		
EXT POLLICIS LONGUS			**ext secundi internodii pollicis** absent	**ext secundi internodii pollicis** O: distal U I: digit 1		
EXT BREVIS DIGITORUM						
PRONATOR TERES	**pronator radii teres** O: medial epicondyle I: distal 2/3 R	**pronator radii teres** O: medial epicondyle I: middle R	**pronator radii teres** O: medial epicondyle I: middle 1/3 R	**pronator radii teres** O: medial epicondyle I: distal R	**pronator radii teres** O: medial epicondyle I: distal R	

	DIPROTODONTIA continued					
	Pseudocheiridae	**Phascolarctidae**		**Vombatidae**		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
FLX CARPI RADIALIS	**flx carpi radialis** I: base MC2	**flx carpi radialis** I: MC3	**flx carpi radialis** O: medial epicondyle I: MC3	**flx carpi radialis** O: medial epicondyle I: MC2	**flx carpi radialis** I: base MC2	
PALMARIS LONGUS	**palmaris longus** present	**palmaris longus** present	**palmaris longus** "well defined, though slender"	**palmaris longus** O: "as usual" / medial epicondyle I: palmar fascia / pad palm of hand	**palmaris longus** O: medial epicondyle I: palmar pad	
FLX DIGITORUM SUPERFICIALIS	**flx sublimis digitorum** O: FDP	**flx sublimis digitorum** O: FDP	**flexor perforatus** O: FDP I: digits 2, 3, 4, 5	**flx sublimis digitorum** O: medial epicondyle I: digits	**flx sublimis digitorum** O: FDP	

	DIPROTODONTIA continued					
	Pseudocheiridae	Phascolarctidae		Vombatidae		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
INTERFLEXORII						
FLX DIGITORUM PROFUNDUS,			**flexores digitorum**	**flx profundus + flx pollicis longus**		
epicondylar				"more or less united"		
epicondylar (FDPe)			O: medial epicondyle			
epicondylar (FDPd)			O: distal medial epicondyle			
ulnar			O: medial olecranon + U			
radial			O: cranial R			
			*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5		

	DIPROTODONTIA continued					
	Pseudocheiridae	Phascolarctidae		Vombatidae		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
LUMBRICALES			**lumbricales** O: FDP I: digits 3, 4	**lumbricales** O: FDP I: digits 2, 3, 4, 5		
FLX CARPI ULNARIS, **epitrochlear belly** **ulnar belly**	**flx carpi ulnaris** I: pisiform	**flx carpi ulnaris** I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: olecranon I: MC5	**flx carpi ulnaris** I: pisiform	
EPITROCHLEO-ANCONEUS	**anconeus internus** O: medial epicondyle I: olecranon	**anconeus internus** O: medial epicondyle I: olecranon	**anconei, internal (anconeus epitrochlearis)** O: medial epicondyle I: medial olecranon	**anconeus internus** present	**anconeus internus** O: medial epicondyle I: olecranon	
PRONATOR QUADRATUS	**pronator quadratus** O: distal 1/6 R + U	**pronator quadratus** O: distal 1/5 R + U	**pronator quadratus** O: distal 1/5 R + U	**pronator quadratus** O: distal 1/3 R + U	**pronator quadratus** O: distal 1/2 R + U	

	DIPROTODONTIA continued					
	Pseudocheiridae	**Phascolarctidae**		**Vombatidae**		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
PALMARIS BREVIS				**palmaris brevis** absent		
FLX DIGITORUM BREVES MANUS						
ABD DIGITI MINIMI			**abd digiti minimi** "usual attachments"			**abd minimi digiti**
ABD POLLICIS BREVIS			**abd pollicis** "usual attachments"	**abd pollicis**		**abd pollicis**
CONTRAHENTES			**add pollicis, add indicis, add minimi digiti** O: MC3 I: 1L, 2L, 5M	**palmar interosseus** I: 1L, 2L, 4M, 5M		**palmar group** O: MC2 I: 1L, 2L, 4M, 5M

	DIPROTODONTIA continued					
	Pseudocheiridae	**Phascolarctidae**		**Vombatidae**		
	Pseudochirus **Sonntag, 1922b**	***Phascolarctos*** **Sonntag, 1922b**	***Phascolarctos*** **Young, 1882**	***Vombatus*** **Macalister, 1870**	***Vombatus*** **Sonntag, 1922b**	***Vombatus*** **Young, 1880**
FLEXOR BREVES PROFUNDUS			**intermediate layer, flexores breves** 9			**intermediate group** 10
INTERMETACARPALES			**abd indicis, dorsal interossei** 4	**dorsal interossei** 5		**dorsal interossei** 3
? Unknown homology			**opp pollicis** absent			**opponens pollicis** absent
? Unknown homology			**opp minimi digiti** "distinct and separate"			**opponens minimi digiti** absent
RADIAL SESAMOID "PRE-POLLUX"						
ULNAR SESAMOID						
CARPAL VIBRISSAE						

	TUBULIDENTATA				
	Orycteropodidae				
	Orycteropus **Galton, 1870**	***Orycteropus*** **Humphry, 1868**	***Orycteropus*** **Sonntag, 1925**	***Orycteropus*** **Thewissen + Badoux, 1986**	***Orycteropus*** **this work**
PANNICULUS CARNOSUS	**panniculus carnosus**	**panniculus** O: back + sides I: w/ LD, PS	**abdomino-humeralis** O: back + sides I: axilla, pectoral crest	**cutaneus trunci**	**panniculus carnosus** O: back + sides I: slips to pectorals
STERNO-FACIALIS					
STERNOMASTOIDEUS	**sterno-mastoid** O: mastoid process I: manubrium	**sterno-mastoid** O: mastoid process I: sternum	**sterno-mastoid** O: paroccipital + mastoid process I: manubrium		**sternomastoideus** O: paroccipital + mastoid process I: manubrium
CLEIDOMASTOIDEUS	**cleido-mastoid** O: mastoid process I: medial clavicle		**cleido-mastoid** O: paroccipital + mastoid process I: middle clavicle		**cleidomastoideus** O: mastoid process I: medial clavicle
CLAVOTRAPEZIUS	**depressor auris** O: base pinna I: manubrium	**depressor auris** O: SM I: sternum .	**depressor auriculae** O: base pinna I: manubrium superficial to SM		**clavotrapezius** O: base pinna I: manubrium w/ SM
CEPHALOHUMERALIS					-
ACROMIOTRAPEZIUS	**trapezius** O: occiput, ligamentum nuchae I: spine scapula	**trapezius** O: occiput, ligamentum nuchae I: acromion + spine scapula	**trapezius** O: occiput, ligamentum nuchae I: spine scapula + fascia of supraspinatus	**trapezius** O: occiput, ligamentum nuchae	**acromiotrapezius** O: occiput, ligamentum nuchae I: acromion + spine scapula * fused w/ ST
DORSO-CUTANEUS					- -
SPINOTRAPEZIUS	**trapezius** O: T1-9, lumbar aponeurosis I: tubercle at middle spine scapula		**trapezius** O: T1-9 I: middle spine scapula	**trapezius** O: T3-8	**spinotrapezius** O: T1-T9 I: middle spine scapula
RHOMBOIDEUS CAPITIS	**occipitoscapular** O: atlas I: w/ SVC		**occipito-scapularis** O: C2-3 I: fascia over supraspinatus		**r. capitis** O: C1-2 I: cranial border scapula
RHOMBOIDEUS CERVICIS	**r. minor** O: occipital crest, ligamentum nuchae I: cranial angle scapula	**r. minor** O: occipital crest, ligamentum nuchae I: base spine scapula	**r. "single sheet"** O: occipital crest, C-T3 verts I: vertebral border scapula	**rhomboideus** O: occipital crest	**r. cervicis** O: occipital crest, ligamentum nuchae I: cranial angle scapula

	TUBULIDENTATA				
	Orycteropodidae				
	Orycteropus **Galton, 1870**	***Orycteropus*** **Humphry, 1868**	***Orycteropus*** **Sonntag, 1925**	***Orycteropus*** **Thewissen + Badoux, 1986**	***Orycteropus*** **this work**
RHOMBOIDEUS THORACIS	**r. major** O: T1-4 I: vertebral border scapula	**r. major**			**r. thoracis** O: T1-4 I: vertebral border + caudal angle scapula
OMOTRANSVERSARIUS "metacromion"	**acromio-basilar** O: atlas I: metacromion	**cervico-humeral** O: atlas I: acromion	**omo-trachelien (figured only)** O: atlas	**omotransversarius** O: atlas	**omotransversarius** O: atlas I: acromion
OMOTRANSVERSARIUS					
OMOHYOIDEUS	**omo-hyoid** absent		**omo-hyoid** absent		**omohyoideus** absent
SERRATUS VENTRALIS CERVICIS	**levator anguli scapulae** O: w/ OMO C2-5 I: w/ SVT on cranial angle scapula	**levator scapulae** O: C2-5 I: w/ SVT on deep surface vertebral border scapula	**levator anguli scapulae** O: C2-5 I: w/ SVT on cranial angle and vertebral border scapula	**serratus ventralis, cervical part** O: C1-7	**serratus ventralis cervicis** O: C2-5 I: w/ SVT on cranial angle and vertebral border scapula
SERRATUS VENTRALIS THORACIS	**serratus magnus** O: ribs 1-8, C5-7 I: deep surface of scapula	**serratus magnus** I: w/ SVC on deep surface vertebral border scapula	**serratus anterior** O: ribs 1-8 I: w/ SVC on cranial angle and vertebral border	**serratus ventralis, thoracic part** O: ribs 1-8	**serratus ventralis thoracis** O: ribs via 8 digitations I: w/ SVC on cranial angle and vertebral border
CLAVODELTOIDEUS	**clavicular deltoid** O: lateral clavicle I: w/ BB in R	**deltoid, one** O: lateral clavicle I: w/ BB in R	**clavicular deltoid** O: lateral clavicle I: w/ BB in R		**clavodeltoideus** O: clavicle I: R deep to BB
ACROMIODELTOIDEUS	**acromial deltoid** O: acromion I: w/ SD on DP ridge	**deltoid, other** O: acromion + spine scapula I: lateral H	**acromial deltoid** O: acromion I: w/ SD on DP ridge		**acromiodeltoideus** O: acromion I: w/ SD on DP ridge
SPINODELTOIDEUS	**scapular deltoid** O: spine scapula I: w/ AD on DP ridge		**scapular deltoid** O: spine scapula I: w/ AD on DP ridge		**spinodeltoideus** O: spine scapula I: w/ AD on DP ridge
TERES MINOR	**teres minor** O: caudal border scapula I: distal GT	**teres minor**	**teres minor** O: caudal border scapula I: distal to GT	**teres minor**	**teres minor** O: caudal border scapula I: distal GT

	TUBULIDENTATA				
	Orycteropodidae				
	Orycteropus **Galton, 1870**	***Orycteropus*** **Humphry, 1868**	***Orycteropus*** **Sonntag, 1925**	***Orycteropus*** **Thewissen + Badoux, 1986**	***Orycteropus*** **this work**
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT	**sub-scapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT		**subscapularis** O: subscapular fossa I: fossa on LT, GHj capsule
TERES MAJOR	**teres major** O: w/ SS + caudal border scapula I: bicipital groove w/ LD	**teres major** O: deep surface caudal angle scapula I: H	**teres major** O: caudal border scapula I: bicipital groove w/ LD		**teres major** O: w/ SS at caudal angle of scapula I: medial H w/ LD
LATISSIMUS DORSI "superficial" "deep"	**latissimus dorsi** O: lumbar fascia, T verts, ribs 10-12 I: bicipital groove w/ TMA	**latissimus dorsi** O: 6T verts, lumbar fascia I: bicipital groove H	**latissimus dorsi** O: 8T verts, thoracolumbar fascia, ribs 10-12 I: medial H w/ TMA	**latissimus dorsi** O: T10 + thoracolumbar fascia	**latissimus dorsi** O: T6-13, thoracolumbar fascia, ribs 10-12 I: medial H w/ TMA
DORSO-EPITROCHLEARIS	**dorso-épitrochlien + triceps, posterior scapular** O: LD + caudal angle scapula	**triceps extensor cubitii, hindmost division** O: LD + caudal angle scapula I: medial olecranon	**dorso-epitrochlearis** O: LD + TMA + caudal angle scapula I: w/ TME olecranon		**dorso-epitrochlearis** O: LD + TMA + caudal angle scapula I: caudo-medial olecranon
PECTORALIS SUPERFICIALIS "clavicular"					
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis major** O: manubrium + sternum I: DP ridge	**pectoralis major, fore part** O: sternum + ribs I: lateral bicipital groove	**pectoralis major** O: manubrium I: lateral H + GT	**pectoralis superficialis descendens** (figured only)	**pectoralis superficialis, superficial part** O: manubrium + sterno-clavicular j I: medial DP crest
PECTORALIS SUPERFICIALIS "deep"	**pectoralis major** O: manubrium + sternum I: DP ridge		**pectoralis major** O: sternum I: lateral H	**pectoralis superficialis transversans** (figured only)	**pectoralis superficialis, deep part** O: sternum I: w/ PSs on medial DP crest
PECTORALIS PROFUNDUS	**pectoralis minor** O: sternum, ribs 4-6 I: over BB and LT + GT	**pectoralis minor** O: 2 ribs I: lateral bicipital groove	**pectoralis minor** O: ribs 5-7 I: aponeurosis connecting PSs + PSd	**pectoralis profundus pars cranialis** O: sternum	**pectoralis profundus** O: sternum I: prox H

	TUBULIDENTATA				
	Orycteropodidae				
	Orycteropus **Galton, 1870**	***Orycteropus*** **Humphry, 1868**	***Orycteropus*** **Sonntag, 1925**	***Orycteropus*** **Thewissen + Badoux, 1986**	***Orycteropus*** **this work**
PECTORALIS ABDOMINALIS	**pectoralis major** O: abdomen	**pectoralis major, hinder portion** O: w/ PS + external oblique + LD	**pectoralis quartus** O: w/ external oblique, ribs, LD I: medial H + GT	**pectoralis profundus pars caudalis** (figured only)	**pectoralis abdominalis** O: lateral thorax I: fascial sac / bursa
SUBCLAVIUS	**subclavius** O: w/ S-S rib 1 + manubrium I: lateral clavicle	**subclavius** O: ribs 1 + 2, sternum I: clavicle	**subclavius** O: manubrium I: into S-S; lateral clavicle	**subclavius** I: ? over coracoclavicular ligament	**subclavius** O: rib 1 + 2, manubrium I: lateral clavicle
STERNOSCAPULARIS	**subclavius** O: w/ SU rib 1 + manubrium I: acromion + fascia over supraspinatus	**subclavius** O: ribs 1 + 2, sternum I: acromion + fascia over supraspinatus	**subclavius** O: rib 1 + manubrium I: acromion + fascia over supraspinatus		**sternoscapularis** O: rib 1 + manubrium I: acromion + fascia over S
CORACOBRACHIALIS	**coraco-brachialis** O: coracoid process I: medial supracondylar ridge	**coraco-brachialis** O: coracoid process I: distal medial H	**coraco-brachialis** O: medial coracoid process I: distal medial H	**coracobrachialis** I: slip to medial epicondyle	**coracobrachialis** O: medial coracoid process I: ovid pit distal H
CORACOBRACHIALIS					
BICEPS BRACHII, short head					**biceps brachii, short head** - -
BICEPS BRACHII, long head	**biceps** O: glenoid I: w/ CD on R	**biceps** O: coracoid process I: R w/ CD	**biceps flexor cubitii** O: glenoid + deep surface coracoid I: w/ CD on R		**biceps brachii, long head** O: supraglenoid tubercle I: R neck
BRACHIALIS	**brachialis anticus** O: lateral H I: coronoid process U + slip to R	**brachialis anticus** O: lateral H I: coronoid process U	**brachialis anticus** O: lateral H I: medial U	**brachialis** I: U	**brachialis** O: distal to H head I: medial U
? CUBITALIS ?		"few fibres BB passed w/ B to U"			
SUPRASPINATUS	**supraspinatus** O: supraspinous fossa I: GT	**supra-spinatus** O: supraspinous fossa I: distal GT	**supraspinatus** O: supraspinous fossa I: GT		**supraspinatus** O: supraspinous fossa I: top GT
INFRASPINATUS	**infraspinatus** O: infraspinous fossa I: fossa on lateral GT	**infra-spinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: lateral GT		**infraspinatus** O: infraspinous fossa I: fossa on lateral GT

	TUBULIDENTATA				
	Orycteropodidae				
	Orycteropus **Galton, 1870**	***Orycteropus*** **Humphry, 1868**	***Orycteropus*** **Sonntag, 1925**	***Orycteropus*** **Thewissen + Badoux, 1986**	***Orycteropus*** **this work**
TRICEPS BRACHII CAPUT LATERALE	**triceps, external** O: neck of H I: w/TLO lateral olecranon	**triceps extensor cubitii, post-glenoid** O: caudal neck scapula I: lateral olecranon	**triceps, outer** O: caudal neck H I: lateral olecranon	**triceps brachii**	**triceps brachii caput laterale** O: distal to H head I: w/ TLO on caudo-lateral olecranon
TRICEPS BRACHII CAPUT MEDIALE	**triceps, internal** O: caudal H I: olecranon w/ D-E	**triceps extensor cubitii, humeral / post brachialis** O: medial H I: cranial olecranon	**triceps, internal** O: caudal H + medial supracondylar ridge I: back of olecranon w/ D-E		**triceps brachii caput mediale** O: caudo-medial H I: medial 1/2 cranial olecranon
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps, anterior scapular** O: caudal border scapula I: olecranon w/ TLO + TLA	**triceps extensor cubitii, large posterior costa** O: caudal border scapula I: ridge beyond olecranon	**triceps, anterior scapular** O: caudal border scapula I: olecranon w/ TLOs + TLA		**triceps brachii caput longum deep** O: neck of scap I: w/ TLOs + TLA on tip of olecranon
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)			**triceps, posterior scapular** O: caudal border scapula I: olecranon w/ D-E + TLOd		**triceps brachii caput longum superficial** O: caudal border scap I: olecranon w/ D-E + TLOd
TRICEPS BRACHII ACCESSORY					
ANCONEUS		**anconeus externus** absent			**anconeus** O: caudo-lateral H I: lateral 1/2 cranial olecranon
BRACHIORADIALIS	**supinator longus** O: caudal H I: distal R + over ext tendons	**supinator longus** O: ? medial supracondylar ridge I: back of carpus	**supinator longus** O: proximal caudal H I: distal R over ext tendons	**brachioradialis** I: proximal to ext retinaculum + R	**brachioradialis** O: caudal neck H I: EDC retinaculum
EXT CARPI RADIALIS, longus (MC2)					
EXT CARPI RADIALIS, brevis (MC3)	**ext carpi radialis** O: supinator ridge H I: base MC2 + 3	**ext carpi radialis** O: lateral supracondylar ridge I: MC3	**ext carpi radialis** O: lateral supracondylar crest I: base MC2 + 3		**ext carpi radialis longus et brevis** O: lateral supracondylar crest I: base MC2 + MC3

	TUBULIDENTATA **Orycteropodidae** ***Orycteropus*** **Galton, 1870**	***Orycteropus*** **Humphry, 1868**	***Orycteropus*** **Sonntag, 1925**	***Orycteropus*** **Thewissen + Badoux, 1986**	***Orycteropus*** **this work**
EXT DIGITORUM COMMUNIS	**ext communis digitorum** O: supinator ridge H I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral supracondylar crest + lateral epicondyle I: digits 2, 3, 4, 5		**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5
EXT DIGITORUM LATERALIS	**ext digiti minimi + ext annularis** O: lateral epicondyle I: digits 3, 4, 5	**ext minimi digiti + ext annularis** O: lateral epicondyle I: digits 4 + 5	**ext minimi digiti + ext annularis** O: lateral epicondyle I: digits 4 + 5 + ulnar sesamoid	**ext digiti IV + ext digiti V** I: digits 4 + 5 + ? 4th carpal	**ext digitorum lateralis** O: lateral epicondyle I: digits 3, 4, 5 * two bellies
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle I: base MC4 + 5	**ext carpi ulnaris** O: lateral epicondyle + U I: MC4 + 5	**ext carpi ulnaris** O: lateral epicondyle I: base MC4 + 5	**ext carpi ulnaris** O: ? far proximal on H	**ext carpi ulnaris** O: lateral epicondyle I: base MC4 + 5
SUPINATOR	**supinator brevis** O: H I: cranial R	**supinator brevis** O: lateral epicondyle I: cranial R			**supinator** O: lateral epicondyle I: cranial R
ABD POLLICIS LONGUS	**ext ossis metacarpi pollicis** O: R + U I: trapezium	**ext ossis metacarpi pollicis** O: R + U I: trapezium / "rudiment of pollex on radial side MC2"	**ext ossis metacarpi pollicis** O: R + U I: trapezium	**ext digiti I** I: ?1st carpal	**abd pollicis longus** O: lateral U + proximal R I: trapezium + sesamoid
EXT DIGITORUM PROFUNDUS	**ext indicis** O: U I: digits 2 + 3	**ext indicis** O: U I: digits 2 + 3	**ext indicis** O: medial U I: digits 2 + 3		**ext digitorum profundus** O: lateral ulna I: digits 2 + 3
EXT BREVIS DIGITORUM					**ext brevis digitorum** absent
PRONATOR TERES	**pronator teres** O: medial epicondyle I: distal R	**pronator radii teres** O: medial epicondyle I: R	**pronator radii teres** O: medial epicondyle I: distal R		**pronator teres** O: medial epicondyle I: cranial R
FLX CARPI RADIALIS	**flx carpi radialis** O: ? lateral epicondyle I: MC2 + R + sesamoid	**flx carpi radialis** O: medial epicondyle I: MC2 (sesamoid)	**flx carpi radialis** O: medial epicondyle I: base MC1 + R + radial sesamoid	**flx carpi radialis** I: base MC2 + sesamoid	**flx carpi radialis** O: medial epicondyle I: palmer base MC2 + R
PALMARIS LONGUS	**palmaris longus** O: medial epicondyle "embedded in FDP" I: digits 2, 3, 4, 5	**palmaris longus** O: medial epicondyle "embedded in FDP" I: digits 2, 3, 4, 5	**palmaris longus** O: medial epicondyle I: CMCj		**palmaris longus** O: medial epicondyle + FDPe I: palmar aponeurosis + flexor retinaculum

	TUBULIDENTATA				
	Orycteropodidae				
	Orycteropus **Galton, 1870**	***Orycteropus*** **Humphry, 1868**	***Orycteropus*** **Sonntag, 1925**	***Orycteropus*** **Thewissen + Badoux, 1986**	***Orycteropus*** **this work**
FLX DIGITORUM SUPERFICIALIS	**flx digitorum sublimis** combined w/ PL but: FDP - digit 3	**flx digitorum sublimis** merged w/ PL	**flx sublimis digitorum** fused w/ PL		**flx digitorum superficialis** absent
INTERFLEXORII					**present**
FLX DIGITORUM PROFUNDUS, epicondylar	**flx profundus digitorum**	**flx digitorum profundus**	**flx profundus digitorum**		**flx digitorum profundus**
epicondylar (FDPe)	O: fossa on caudal H	O: medial epicondyle	O: medial epicondyle		O: medial epicondyle I: medial edge conjoined F tendon
epicondylar (FDPd)	O: FDPe				O: medial epicondyle I: FDPe
ulnar	O: U	O: U	O: distal U		O: medial olecranon + U I: conjoined F
radial	O: R *I: dig 2, 3, 4, 5	O: R *I: dig 2, 3, 4, 5	O: R *I: dig 2, 3, 4, 5		O: medial R I: medial side conjoined F *I: dig 2, 3, 4, 5
LUMBRICALES	**lumbricales** O: FDP I: medial dig 2, 3, 4, 5	**lumbricales** O: FDP I: medial dig 2, 3, 4, 5	**lumbricales** O: FDP I: medial dig 2, 3, 4, 5	**lumbricales** O: FDP	**lumbricales** O: FDP tendon I: medial dig 2, 3, 4, 5
FLX CARPI ULNARIS, epitrochlear belly **ulnar belly**	**flx carpi ulnaris** O: U I: pisiform, unciform, digit 5	**flx carpi ulnaris** as in man	**flx carpi ulnaris** O: FDS + FDP O: U I: pisiform, unciform, base MC5		**flx carpi ulnaris** O: vestigial O: medial olecranon + U I: pisiform
EPITROCHLEO-ANCONEUS	**epitrochleo-anconeus** O: medial epicondyle I: medial olecranon	**anconeus internus** O: medial epicondyle I: medial olecranon	**epitrochleo-anconeus** "nothing peculiar"		**epitrochleo-anconeus** O: caudal medial epicondyle I: medial olecranon
PRONATOR QUADRATUS	**pronator quadratus** O: interosseus space	**pronator quadratus** "small"	**pronator quadratus** O: interosseus space I: w/ FCR	**pronator quadratus**	**pronator quadratus** O: proximal R I: distal U

	TUBULIDENTATA				
	Orycteropodidae				
	Orycteropus **Galton, 1870**	***Orycteropus*** **Humphry, 1868**	***Orycteropus*** **Sonntag, 1925**	***Orycteropus*** **Thewissen + Badoux, 1986**	***Orycteropus*** **this work**
PALMARIS BREVIS			**palmaris brevis** absent		**palmaris brevis** absent
FLX DIGITORUM BREVIS MANUS	**flexor profundus digitorum** O: ulnar sesamoid I: digit 4				**flexor digitorum breves manus** ?
ABD DIGITI MINIMI	**abd minimi digiti** O: unciform I: digit 5	**abd minimi digiti** O: lateral MC5 I: lateral digit 5	**abd minimi digiti** O: unciform I: sesamoid digit 5		**abd digiti minimi** O: pisiform I: lateral MC5
ABD POLLICIS BREVIS					**abd pollicis brevis** -
CONTRAHENTES	**superficial interossei** O: base MC I: digits 2, 5	**palmar interossei** O: base MC I: digits 2, 4, 5	**adductor indicis, adductor minimi digiti** O: base MC, unciform I: digits 2, 5	**adductor digiti I + adductor digiti V** I: digit 1 or 2; tendon EDC	**contrahentes** O: carpus I: digits 2, 5
FLEXOR BREVES PROFUNDUS	**deep interossei** 8	**dorsal interossei** 8 O: base MC	**interossei** 6 O: MC ligaments	**interossei** 8 O: MC ligaments	**flexor breves profundus** 8 O: fibrous sheet
INTERMETACARPALES	**abd indicis**		**abd indicis**		**abd indicis**
RADIAL SESAMOID "PRE-POLLUX"	present - in flx retinaculum				present - in flx retinaculum
ULNAR SESAMOID	present - base MC5				present - base MC5
CARPAL VIBRISSAE					

	AFROSORICIDA						
	Chrysochloridae						
	Ambly-somus **Dobson, 1883**	***Calco-chloris*** **this work**	***Chryso-spalax*** **Campbell, 1938**	***Eremitalpa*** **Gasc et al., 1986**	***Chryso-spalax*** **Parsons, 1901**	***Chryso-chloris?*** **Jullien, 1967**	***Chryso-chloris*** **Puttick & Jarvis, 1977**
PANNICULUS CARNOSUS	**acromio-cuticularis** O: back + sides I: acromion	**panniculus carnosus** O: back + sides I: metacromion	**panniculus carnosus** O: back + sides I: metacromion		**panniculus carnosus** O: back + sides I: acromion		
STERNO-FACIALIS					**sterno-facialis** absent		
STERNOMASTOIDEUS	**sterno-mastoid** O: mastoid process w/CM I: sternum	**sternomastoideus** O: behind EAM / mastoid process I: manubrium	**sternomastoid**	**sternomastoideus** O: mastoid process I: manubrium	**sterno-mastoid** I: sternum	**"poor conservation"**	
CLEIDOMASTOIDEUS	**cleido-mastoid** O: mastoid process w/SM I: medial clavicle	**cleidomastoideus** O: behind EAM / mastoid process I: sternoclavicular joint	**cleido-mastoid** O: w/ CT I: clavicle	**cleidomastoideus** O: mastoid process I: medial clavicle	**cleido-mastoid** I: clavicle	**"poor conservation"**	
CLAVOTRAPEZIUS	**cleido-occipital** O: occipital crest I: medial clavicle	**clavotrapezius** O: lateral occiput I: medial clavicle	**cleido-occipitalis** O: CM I: clavicle		**cleido-occipital** I: clavicle	**"poor conservation"**	**cleido-occipitalis** O: occipital crest I: medial clavicle
CEPHALOHUMERALIS							

	AFROSORICIDA						
	Chrysochloridae						
	Ambly-somus **Dobson, 1883**	***Calco-chloris*** **this work**	***Chryso-spalax*** **Campbell, 1938**	***Eremitalpa*** **Gasc et al., 1986**	***Chryso-spalax*** **Parsons, 1901**	***Chryso-chloris?*** **Jullien, 1967**	***Chryso-chloris*** **Puttick & Jarvis, 1977**
ACROMIOTRAPEZIUS	**trapezius anticus** O: occipital crest I: acromion + spine scapula	**acromiotrapezius** O: occipital crest + C verts I: metacromion + fascia over ROC * bifurcates weakly	**trapezius, anterior** O: occipital crest + C verts I: metacromion * bifid	**trapezius pars anterior** O: occipital crest I: metacromion + spine scapula	**trapezius, anterior** I: acromion	**trapèze antérieur** O: occipital crest + C verts I: metacromion + spine scapula * bifid	**trapezius anticus** O: occipital crest I: spine scapula
DORSO-CUTANEUS							
SPINOTRAPEZIUS	**trapezius posticus** O: T9 I: posterior spine scapula	**spinotrapezius** O: mid-T verts I: tuber on middle spine scapula	**trapezius, posterior** O: mid-T verts I: tuber on middle spine scapula	**trapezius pars posterior** O: T12-L2 I: spine scapula		**trapezius postérieur** "poor conservation" I: base spine scapula	**trapezius posticus** O: T9 I: base spine scapula
RHOMBOIDEUS CAPITIS	**r. anticus, superficial** O: occipital crest + ligamentum nuchae I: vertebral border and caudal angle scapula		**r. capitis** O: occipital crest I: acromion + spine scapula	**rhomboideus pars occipitalis** O: occipital crest I: vertebral border scapula		**r. occipital** O: occipital crest I: surround supraspinous fossa	**rhomboideus, superficial** O: occipital crest I: acromion + spine of scapula

	AFROSORICIDA						
	Chrysochloridae						
	Ambly-somus **Dobson, 1883**	***Calco-chloris*** **this work**	***Chryso-spalax*** **Campbell, 1938**	***Eremitalpa*** **Gasc et al., 1986**	***Chryso-spalax*** **Parsons, 1901**	***Chryso-chloris?*** **Jullien, 1967**	***Chryso-chloris*** **Puttick & Jarvis, 1977**
RHOMBOIDEUS CERVICIS	**r. anticus, deep** O: occiput I: spine of scapula	**r. capitis et cervicis** O: occipital crest + C vertebrae I: spine of the scapula + fossa at base spine scapula	**r. cervicis** O: w/ RO occipital crest + C verts I: spine scapula + fossa at base spine scapula	**rhomboideus pars cervicalis** O: cervical fascia I: cranial angle scapula		**r. cervical** O: occipital crest + ligamentum nuchae I: triangular depression near supraspinous fossa	**rhomboideus, deep** O: occipital crest I: ridge at base spine scapula
RHOMBOIDEUS THORACIS	**transversus scapularum** O: opposite partner I : SVT at caudal angle	**r. thoracis** O: T1-2 I: vertebral border scapula	**r. thoracis** O: opposite partner I: caudal angle scapula	**rhomboideus pars interscapularis** O: opposite partner I: caudal angle scapula	**hinder (caudal) part of the rhomboids** I: w/ partner across midline	**r. dorsal** O: T1 I: vertebral border scapula	
OMOTRANSVERSARIUS "metacromion"	**levator claviculae** O: atlas I: tip metacromion	**omotransversarius, ventral portion** O: atlas I: metacromion	**atlantoscapularis anterior** O: atlas I: tip metacromion	**levator scapulae ventralis** O: atlas I: metacromion	**levator claviculae** O: atlas I: tip metacromion	**acromio-trachélien** O: atlas I: tip metacromion	**atlantoscapularis** O: atlas I: acromion
OMOTRANSVERSARIUS	**levator scapulae** O:atlas I: base metacromion / spine of scapula	**omotransversarius, dorsal portion** O: atlas I: cranial edge acromion	**atlantoscapularis anterior** O: atlas I: cranial edge acromion	**levator scapulae ventralis** O: C3 I: metacromion	**levator scapulae** O:atlas I: base metacromion / spine of scapula	**acromio-trachélien** O: atlas I: edge metacromion	**atlantoscapularis** O: atlas I: base acromion
OMOHYOIDEUS		**omohyoideus** absent					

	AFROSORICIDA Chrysochloridae						
	Ambly-somus **Dobson, 1883**	***Calco-chloris*** **this work**	***Chryso-spalax*** **Campbell, 1938**	***Eremitalpa*** **Gasc et al., 1986**	***Chryso-spalax*** **Parsons, 1901**	***Chryso-chloris?*** **Jullien, 1967**	***Chryso-chloris*** **Puttick & Jarvis, 1977**
SERRATUS VENTRALIS CERVICIS	**levator angulae scapulae** O: C3-7 I: w/ SVT cranial edge scapula spine and subscapular fossa	**serratus ventralis cervicis** O: C3-7 I: acromioclavicular joint, cranial border to cranial angle scapula	**serratus anterior, cervical** O: C3-7 I: acromioclavicular joint, cranial border to cranial angle scapula	**levator scapulae dorsalis** O: C3 I: spine scapula	**levator angulae scapulae** O: C3-7 I: w/ SVT cranial edge scapula spine and subscapular fossa	**elévator de l'omoplate** I: acromion, cranial border to angle scapula	**laevator angulae scapulae** O: C3-C7 I: w/ SVT acromioclavicular j, spine scapula, fascia supraspinatus
SERRATUS VENTRALIS THORACIS	**serratus magnus** O: ribs 1-8 I: w/ SVC cranial edge scapula spine and subscapular fossa	**serratus ventralis thoracis** O: ribs 1-9 I: deep vertebral border scapula	**serratus anterior, thoracic** O: ribs 1-10 I: vertebral border scapula		**serratus magnus** O: ribs 1-8 I: w/ SVC cranial edge scapula spine and subscapular fossa	**grand dentelé** O: ribs via 9 digitations I: deep vertebral border scapula	**serratus magnus** O: w/ SVC T1-9 I: w/ SVC acromioclavicular j, spine scapula, fascia supraspinatus
CLAVODELTOIDEUS	**clavicular pectoral** O: middle clavicle I: lateral H	**clavodeltoideus** O: clavicle I: lateral H	**cleidodeltoideus (acromiodeltoideus)** O: medial clavicle I: proximal DP ridge	**deltoideus pars clavicularis** O: clavicle I: distal H	**deltoid, clavicular** fused w/ AD		
ACROMIODELTOIDEUS	**deltoid** O: lateral clavicle + metacromion I: distal H	**acromiodeltoideus** O: acromion + clavicle I: distal H	**cleidodeltoideus (acromiodeltoideus)** O: acromion + lateral clavicle I: distal DP ridge		**deltoid, acromial** fused w/ CD	**acromio-deltoïde** O: acromion + clavicle I: lateral DP crest	**cleidodeltoideus** O: lateral clavicle + metacromion I: distal H
SPINODELTOIDEUS	**teres minor** O: w/ subscapularis I: middle H	**spinodeltoideus** O: spine of scapula I: craniolateral H	**spinodeltoideus** O: caudal border + spine scapula I: lateral H	**deltoideus pars scapularis** O: spine scapula I: distal H	**deltoid, spinous** "large"	**spino-deltoïde** O: spine scapula I: lateral DP crest	**spinodeltoideus** O: spine scapula I: lateral H

	AFROSORICIDA						
	Chrysochloridae						
	Ambly-somus **Dobson, 1883**	***Calco-chloris*** **this work**	***Chryso-spalax*** **Campbell, 1938**	***Eremitalpa*** **Gasc et al., 1986**	***Chryso-spalax*** **Parsons, 1901**	***Chryso-chloris?*** **Jullien, 1967**	***Chryso-chloris*** **Puttick & Jarvis, 1977**
TERES MINOR		**teres minor** O: w/ IN caudal border scapula + deep acromion I: fossa on GT			**teres minor** absent	**petit rond** absent	
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**sous-scapulaire** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT
TERES MAJOR	**teres major** O: caudal angle scapula I: w/ LD medial epicondyle	**teres major** O: caudal angle scapula I: medial H	**teres major** O: caudal angle scapula I: medial H		**teres major** "usual attachments"	**grand rond** O: caudal border scapula I: medial H	**teres major** O: caudal angle scapula I: medial H
LATISSIMUS DORSI "superficial" "deep"	**latissimus dorsi + pectoralis major, dorsal part** O: T7-15; ribs 12-17 I: medial epicondyle w/ TMA; LT * 2 insertions	**latissimus dorsi** O: T verts I: slip w/ TMA + medial epicondyle I: w/ PP	**latissimus dorsi** O: T verts, ribs / ribs 12-17 I: medial epicondyle I: on PS	**latissimus dorsi** O: T11-L3 I: medial epicondyle	**latissimus dorsi** O: T7-15; ribs 12-17 I: medial epicondyle	**grand dorsal** O: T verts I: medial epicondyle I: w/ PS	**latissimus dorsi** O: T verts, ribs / ribs 12-17 I: medial epicondyle I: on PS
DORSO-EPITROCHLEARIS	**dorso-epitrochlearis** O: LD I: "third bone"	**dorso-epitrochlearis** O: vertebral + caudal border scapula I: tip medially curved olecranon	**see : triceps, scapular**	**teres major** O: caudal angle scapula I: olecranon	**triceps, fourth** O: caudal angle scapula	**dorso-épitrochléo-olécrânien** "does not exist" but see triceps long chef	**dorso-epitrochlearis** O: LD I: tb

	AFROSORICIDA						
	Chrysochloridae						
	Ambly-somus **Dobson, 1883**	***Calco-chloris*** **this work**	***Chryso-spalax*** **Campbell, 1938**	***Eremitalpa*** **Gasc et al., 1986**	***Chryso-spalax*** **Parsons, 1901**	***Chryso-chloris?*** **Jullien, 1967**	***Chryso-chloris*** **Puttick & Jarvis, 1977**
PECTORALIS SUPERFICIALIS "clavicular"	**pectoralis major, anterior sternal** O: sternum I: distal third H			**pectoralis pars clavicularis (figure only)** O: manubrium + clavicle I: lateral H			
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis major, middle sternal** O: sternum I: distal third H	**pectoralis superficialis** O: manubrium I: cranio-lateral H	**pectoralis superficialis (et profundus)** O: manubrium + sternum I: DP tuberosity	**pectoralis major / pectoralis pars sternalis** O: sternum I: distal DP ridge		**grand pectoral, anterieure** O: manubrium + rib 2 I:	**pectoralis, sternal part** O: sternum I: DP tuberosity
PECTORALIS SUPERFICIALIS "deep"	**pectoralis major, posterior sternal** O: sternum + ribs I: lateral H, across biceps to LT	"PS has appearance of division near insertion"				**grand pectoral, sternal** O: sternum + ribs 2 + 3 I: medial DP crest	
PECTORALIS PROFUNDUS	**pectoralis major, postero-external** O: ribs 8-10	**pectoralis profundus** O: w/ S-S ribs + sternum I: LT + triangle tubercle on distal craniolateral H	**pectoralis superficialis (et profundus)** O: ribs I: LT + fascia arch over BB			**petit pectoral** O: manubrium + rib 1 I: medial DP crest	**pectoralis, ribs part** O: ribs I: LT
PECTORALIS ABDOMINALIS	**pectoralis major, antero-external** O: ribs 5-7	**pectoralis abdominalis** O: 1 rib I: fascia in axilla					

	AFROSORICIDA						
	Chrysochloridae						
	Ambly-somus **Dobson, 1883**	***Calco-chloris*** **this work**	***Chryso-spalax*** **Campbell, 1938**	***Eremitalpa*** **Gasc et al., 1986**	***Chryso-spalax*** **Parsons, 1901**	***Chryso-chloris?*** **Jullien, 1967**	***Chryso-chloris*** **Puttick & Jarvis, 1977**
SUBCLAVIUS	**subclavius** O: manubrium I: lateral clavicle	**subclavius** O: manubrium I: lateral clavicle	**subclavius** O: manubrium I: lateral clavicle	**subclavius** O: sternum I: lateral clavicle + acromion	**subclavius** O: S-S I: clavicle	**sous-clavier** O: manubrium I: lateral clavicle	**subclavius** O: manubrium I: lateral clavicle, GT, glenoid, fascia supraspinatus
STERNOSCAPULARIS	**sterno-clavicularis/sterno-scapulatus** O: rib 1 I: glenoid rim, fascia of supraspinatus, acromion	**costoscapularis** O: w/PP ribs + sternum I: lateral clavicle + GT	**subclavius** O: rib 1 I: lateral clavicle + GT + fascia supraspinatus	**costo-scapularis** O: ribs 1-2 I: acromion	**sterno-scapular** O: rib 1 I: clavicle + fascia supraspinatus	**costo-scapulaire** O: rib 1 I: lateral clavicle, acromion, neck of scapula	**see subclavius**
CORACOBRACHIALIS		**coracobrachialis** absent	**coracobrachialis** absent			**coraco-brachial** absent	
CORACOBRACHIALIS							
BICEPS BRACHII, short head							

	AFROSORICIDA						
	Chrysochloridae						
	Ambly-somus **Dobson, 1883**	***Calco-chloris*** **this work**	***Chryso-spalax*** **Campbell, 1938**	***Eremitalpa*** **Gasc et al., 1986**	***Chryso-spalax*** **Parsons, 1901**	***Chryso-chloris?*** **Jullien, 1967**	***Chryso-chloris*** **Puttick & Jarvis, 1977**
BICEPS BRACHII, long head	**biceps** O: glenoid rim I: R	**biceps brachii** O: supraglenoid tubercle I: neck R	**biceps brachii** O: glenoid I: R + U	**biceps** O: supraglenoid tuberosity		**biceps** O: glenoid rim I: caudal R	**biceps** O: glenoid I: R
BRACHIALIS	**brachialis anticus** absent	**brachialis** O: medial + lateral neck H I: medial U	**brachialis anterior** O: neck H I: w/ BB on R + U	**brachialis** absent	**brachialis anticus** O: caudal neck H I: U	**brachial antérieur** O: caudo-lateral H I: medial U	**brachialis anticus** O: neck H I: U
? CUBITALIS ?		**cubitalis** O: distal cranial H I: U					
SUPRASPINATUS	**supra-spinatus** O: supraspinous fossa I: GT	**supraspinatus** O: lateral supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supra-spinatus** O: supraspinous fossa I: GT	**sus-épineux** O: supraspinous fossa I: neck of H	**supraspinatus** O: supraspinous fossa I: GT
INFRASPINATUS	**infra-spinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: fossa on GT	**infraspinatus** O: infraspinous fossa I: lateral GT	**infraspinatus** O: infraspinous fossa I: GT	**infra-spinatus** O: infraspinous fossa I: GT	**sous-épineux** O: infraspinous fossa I: fossa on GT	**infraspinatus** O: infraspinous fossa I: GT
TRICEPS BRACHII CAPUT LATERALE	**triceps, external** O: w/ TME from LT to middle H I: olecranon	**triceps brachii caput laterale** O: caudal border scapula I: lateral olecranon		**triceps**	**triceps, external**	**triceps long chef** O: vertebral + caudal border scapula I: olecranon	**triceps, humeral** O: between head + LT

	AFROSORICIDA						
	Chrysochloridae						
	Ambly-somus **Dobson, 1883**	***Calco-chloris*** **this work**	***Chryso-spalax*** **Campbell, 1938**	***Eremitalpa*** **Gasc et al., 1986**	***Chryso-spalax*** **Parsons, 1901**	***Chryso-chloris?*** **Jullien, 1967**	***Chryso-chloris*** **Puttick & Jarvis, 1977**
TRICEPS BRACHII CAPUT MEDIALE	**triceps, internal** O: w/ TLA from LT to middle H I: olecranon	**triceps brachii caput mediale** O: medial H I: medial half cranial olecranon	**triceps, lateral and medial** O: neck I: olecranon		**triceps, internal**	**triceps vaste interne** O: distal 1/3 caudal H I: olecranon	**triceps, humeral** O: between head + LT
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps, scapular** O: caudal border scapula I: olecranon	**triceps brachii caput longum deep** O: neck scapula I: caudal curve olecranon	**triceps, scapular** O: vertebral + caudal border scapula I: lateral olecranon		**triceps, long or middle** O: caudal border scapula	**triceps long chef** O: vertebral + caudal border scapula I: olecranon	**triceps, scapular** O: vertebral border scapula
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)		**triceps brachii caput longum superficial** O: caudal border scapula I: tip olecranon					
TRICEPS BRACHII ACCESSORY							
ANCONEUS	**anconeus externus** I: lateral U	**anconeus** O: fossa base LT + glenohumeral joint capsule I: lateral olecranon, lateral epicondyle	**triceps, medial + anconeus** O: fossa near LT I: olecranon		**anconeus** present	**triceps vaste interne** O: tuberosity on caudal H I: olecranon	**anconeus** O: olecranon fossa H I: olecranon
BRACHIORADIALIS	**supinator longus** absent	**brachioradialis** absent			**supinator longus** absent	**brachio-radial** absent	

	AFROSORICIDA						
	Chrysochloridae						
	Ambly-somus **Dobson, 1883**	***Calco-chloris*** **this work**	***Chryso-spalax*** **Campbell, 1938**	***Eremitalpa*** **Gasc et al., 1986**	***Chryso-spalax*** **Parsons, 1901**	***Chryso-chloris?*** **Jullien, 1967**	***Chryso-chloris*** **Puttick & Jarvis, 1977**
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis** O: lateral epicondyle I: base MC2			**ext carpi radialis** O: lateral epicondyle I: MC2	**ext carpi radialis longior** absent		**ext carpi radialis** O: lateral epicondyle I: MC2
EXT CARPI RADIALIS, brevis (MC3)		**ext carpi radialis brevis** O: lateral epicondyle I: base MC3			**ext carpi radialis brevior** O: lateral epicondyle I: MC3	**extenseur radial du carpe** O: lateral supracondylar crest I: MC3	
EXT DIGITORUM COMMUNIS	**ext digitorum communis** O: lateral epicondyle I: digit 3, MC4	**ext digitorum communis** O: lateral epicondyle I: digits 1, 2, 3		**ext digitorum communis** O: lateral epicondyle I: base MC2, digit 3	**ext communis digitorum** I: digits 3, 4	**extenseur commun des doigts** O: lateral supracondylar crest I: digits 2, 3	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3
EXT DIGITORUM LATERALIS	**ext minimi digiti** O: lateral epicondyle I: digit 4	**ext digitorum lateralis** O: lateral epicondyle I: base MC3 (ligamentous loop)		**ext lateralis** O: olecranon I: base MC4 (ligamentous loop)	**ext minimi digiti** I: digit 4 or 5	**extenseur du V** O: lateral epicondyle I: digit 3, MC4	**ext minimi digiti** O: lateral epicondyle I: digit 4 (ligamentous loop)
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle + U I: unciform	**ext carpi ulnaris** O: lateral epicondyle I: MC4		**ext carpi ulnaris** O: lateral epicondyle I: base MC3	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**extenseur cubital du carpe** O: lateral epicondyle I: MC4	**ext carpi ulnaris** O: lateral olecranon I: unciform
SUPINATOR	**supinator brevis** O: lateral epicondyle I: proximal R	**supinator** O: cranial surface lateral epicondyle I: cranial R				**supinateur**	**supinator brevis** O: lateral epicondyle I: proximal R

	AFROSORICIDA						
	Chrysochloridae						
	Ambly-somus **Dobson, 1883**	***Calco-chloris*** **this work**	***Chryso-spalax*** **Campbell, 1938**	***Eremitalpa*** **Gasc et al., 1986**	***Chryso-spalax*** **Parsons, 1901**	***Chryso-chloris?*** **Jullien, 1967**	***Chryso-chloris*** **Puttick & Jarvis, 1977**
ABD POLLICIS LONGUS	**extensor ossis metacarpi pollicis** O: lateral U I: base MC1	**abd pollicis longus** O: proximal lateral U I: base MC1 + 2		**abd pollicis longus** O: lateral epicondyle I: MC1		**long abducteur du pouce** O: lateral U + R I: MC1	**extensor ossi metacarpi pollicis** O: proximal U I: MC1
EXT DIGITORUM PROFUNDUS	**ext secundi internodii pollicis et extensor indicis** O: U I: digit 2	**ext digitorum profundus** O: proximal lateral U I: digits 2 + 3		**ext profundus** I: MC2		**extenseur profond des doigts** O: cranio-lateral olecranon I: digit 2	**ext indicis** O: cranial surface lateral epicondyle I: MC2
EXT BREVIS DIGITORUM		**ext brevis digitorum** absent					
PRONATOR TERES	**pronator radii teres** O: medial epicondyle I: distal R	**pronator teres** O: cranial surface medial epicondyle I: medial R		**pronator teres radii** O: medial epicondyle I: middle R		**rond pronateur** O: medial epicondyle I: cranial R	**pronator radii teres** O: medial epicondyle I: medial R
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: base MC2	**flx carpi radialis** O: medial epicondyle I: base palmar MC2		**flx carpi radialis** O: medial epicondyle I: trapezium	**flx carpi radialis** "no osseus tunnel"	**fléchisseur radial du carpe** O: medial epicondyle I: base palmar MC2	**flx carpi radialis** O: medial epicondyle I: MC2
PALMARIS LONGUS	**flx digitorum sublmis** O: medial epicondyle I: digit 2f	**palmaris longus (u)** O: caudal surface medial epicondyle I: flexor retinaculum		**flx digitorum superficialis** O: medial epicondyle I: transverse ligament of wrist	**palmaris longus** sometimes absent	**long palmaire** absent	**flexor digitorum sublimis** O: medial epicondyle I: digit 2

	AFROSORICIDA						
	Chrysochloridae						
	Ambly-somus **Dobson, 1883**	***Calco-chloris*** **this work**	***Chryso-spalax*** **Campbell, 1938**	***Eremitalpa*** **Gasc et al., 1986**	***Chryso-spalax*** **Parsons, 1901**	***Chryso-chloris?*** **Jullien, 1967**	***Chryso-chloris*** **Puttick & Jarvis, 1977**
FLX DIGITORUM SUPERFICIALIS		**flx digitorum superficialis** absent			**flx sublimis digitorum** absent	**fléchisseur superficiel des doigts** O: distal medial epicondyle I: digit 2 = p	
INTERFLEXORII							
FLX DIGITORUM PROFUNDUS,	**flx digitorum profundus**	**flexor digitorum profundus**		**flexor digitorum profundus**	**flx profondus digitorum**	**fléchisseur profond des doigts**	**flexor digitorum profundus**
epicondylar							
epicondylar (FDPe)	O: medial epicondyle	O: caudal tip of medial epicondyle I: w/ FDPd		O: medial epicondyle	O: medial epicondyle	(O = FDS?)	(O = FDS?)
epicondylar (FDPd)	O: medial epicondyle	O :caudal surface medial epicondyle I: "third bone"					
ulnar	O: U	O: caudo-medial olecranon + U I: "third bone"		O: U	O: U		O: U
radial							
	*I: digits 1, 2, 3, 4	*I: digits 1, 2, 3, 4		*I: base MC1 + 4 by ligaments, digits 2, 3, 4	*I: digits 3, 4, 5	*I: digits 1, 2, 3	*I: tb
LUMBRICALES		**lumbricales** absent			**lumbricales** absent	**lombricaux** absent	

	AFROSORICIDA						
	Chrysochloridae						
	Ambly-somus **Dobson, 1883**	***Calco-chloris*** **this work**	***Chryso-spalax*** **Campbell, 1938**	***Eremitalpa*** **Gasc et al., 1986**	***Chryso-spalax*** **Parsons, 1901**	***Chryso-chloris?*** **Jullien, 1967**	***Chryso-chloris*** **Puttick & Jarvis, 1977**
FLX CARPI ULNARIS, **epitrochlear belly** **ulnar belly**		**flx carpi ulnaris** O: medial olecranon I: pisiform		**flx carpi ulnaris** O: olecranon I: ulnar carpal	**flx carpi ulnaris** O: medial olecranon I: pisiform	**fléchisseur cubital du carpe** O: medial olecranon I: pisiform	
EPITROCHLEO-ANCONEUS		**epitrochleo-anconeus** O: medial tip olecranon I: distal caudal H			**epitrochleo-anconeus** "massive"	**épitrochléo-olécrânien** O: medial epicondyle I: medial olecranon	
PRONATOR QUADRATUS		**pronator quadratus** absent			**pronator quadratus** absent	**carré pronateur** absent	
PALMARIS BREVIS		**palmaris brevis** absent				**court palmaire** absent	
FLX DIGITORUM BREVIS MANUS		**flexor digitorum breves manus** O: flexor retinaculum I: digits (?1), 2, (?4)				**court fléchisseur des doigts de la main** absent (but see FDS 2f)	(but see FDS 2f)
ABD DIGITI MINIMI		**abd digiti minimi** O: ?pisiform I: base digit 4				**abducteur du V** absent	

	AFROSORICIDA						
	Chrysochloridae						
	Ambly-somus **Dobson, 1883**	***Calco-chloris*** **this work**	***Chryso-spalax*** **Campbell, 1938**	***Eremitalpa*** **Gasc et al., 1986**	***Chryso-spalax*** **Parsons, 1901**	***Chryso-chloris?*** **Jullien, 1967**	***Chryso-chloris*** **Puttick & Jarvis, 1977**
ABD POLLICIS BREVIS		**abd pollicis brevis** absent				**abducteur du I** absent	
CONTRAHENTES		**contrahentes** absent		**contrahentes** binding MC1 + 2		**contracteurs des doigts** absent	
FLEXOR BREVES PROFUNDUS		**flexor breves profundus** ? maybe 1				**muscles interosseux** absent	
INTERMETACARPALES		**intermetacarpales** absent					
? Unknown homology				**dorso-epitrochlearis** O: LD I: distal R			
RADIAL SESAMOID "PRE-POLLUX"							
ULNAR SESAMOID							
CARPAL VIBRISSAE							

	AFROSORICIDA								
	Tenrecidae								
	Potamogale **Dobson, 1883**	***Potamogale*** **Jullien, 1967**	***Potamogale*** **this work**	***Micropotamogale*** **Verheyen, 1961**	***Microgale*** **Dobson, 1882a**	***Microgale*** **this work**	***Setifer*** **Dobson, 1882**	***Tenrec*** **Dobson, 1882**	***Tenrec*** **Neveu + Gasc, 2002**
PANNICULUS CARNOSUS	**humero-dorsales** O: back + sides I: bicipital ridge		**panniculus carnosus** O: back + sides I: w/ deltoid on H; w/ mammary gland	**humero-abdominalis** O: flank I: LD + w/ PP on H		**panniculus carnosus** O: back + sides I: 2 slips w/ PP on H	**panniculus carnosus**	**panniculus carnosus** O: back + sides I: w/ PP, w/ mammary gland, by TLA + TMA	
STERNO-FACIALIS									
STERNOMASTOIDEUS	**sternomastoid** O: mastoid process w/CM I: sternum + rib 1 + ventral raphe	**sterno-mastoïdien** O: petromastoid I: fibrous raphe in front of sternum	**sternomastoideus** O: mastoid process I: manubrium + ventral raphe	**sterno-mastoideus** O: just behind ear I: manubrium + ventral raphe	**sterno-mastoid** O: mastoid process I: sternum + sterno-clavicular j + ventral raphe	**sternomastoideus** O: mastoid process I: manubrium + sternum		**sterno-mastoid** O: mastoid process I: sternum + sterno-clavicular j + ventral raphe	**sterno-mastoideus** O: mastoid w/CM I: distal sternum
CLEIDOMASTOIDEUS	**cleido-occipital** O: occipital crest w/ ear slip I: ventral raphe deep to SM	**sterno-occipital** O: occipital crest I: ventral raphe + sternum	**cleidomastoideus** O: occipital crest w/ ear slip I: near sternum	**sterno-occipitalis** O: near occipital crest w/ slip to pinna I: caudal manubrium	**cleido-mastoid** O: mastoid process I: sternum	**cleidomastoideus** O: occiput I: manubrium		**cleido-mastoid** O: mastoid process I: sternum	**cleido-mastoideus** O: mastoid w/SM I: clavicle proximal to CT
CLAVOTRAPEZIUS		**cléido-occipital** O: occipital crest I: vestigial clavicle	**clavotrapezius** O: occiput I: fibrous clavicle	**cleido-occipital, sterno-occipital**		**clavotrapezius** O: occipital crest I: lateral clavicle		**cleido-occipital** O: w/ AT occipital crest I: sternum	**cleido-occipitalis** O: occipital crest I: clavicle distal to CM
CEPHALOHUMERALIS			**CT + OT / CD**			-			

	AFROSORICIDA								
	Tenrecidae								
	Potamogale **Dobson, 1883**	***Potamogale*** **Jullien, 1967**	***Potamogale*** **this work**	***Micropotamogale*** **Verheyen, 1961**	***Microgale*** **Dobson, 1882a**	***Microgale*** **this work**	***Setifer*** **Dobson, 1882**	***Tenrec*** **Dobson, 1882**	***Tenrec*** **Neveu + Gasc, 2002**
ACROMIOTRAPEZIUS	**trapezius anticus** O: occipital crest, ligamentum nuchae + T1-4 I: spine of scapula	**trapèze antérieur** O: occipital crest, ligamentum nuchae, T1 I: lateral 2/3 spine scapula * bifid (really w/ AD)	**acromiotrapezius** O: occiput, ligamentum nuchae, T1-2 I: acromiodeltoideus	**trapezius "anterior fibers"** O: mid-dorsal raphe neck and back I: H		**acromiotrapezius** O: occipital crest, C + T verts I: acromion + spine scapula		**trapezius anterior** O: occipital crest, ligamentum nuchae, T1-2 I: acromion + spine scapula	**trapezius anterior** O: occipital crest, ligamentum nuchae, T1 I: spine scapula + metacromion
DORSO-CUTANEUS			**dorso-cutaneus** O: dorsal midline deep PC, above LD I: over shoulder	**humero-dorsalis** O: skin of the back above LD I: cranial H		**?** ? ?			
SPINOTRAPEZIUS	**trapezius posticus** O: "as usual" I: "as usual"	**trapezius postérieur** ? I: post 1/3 scap spine	**spinotrapezius** O: L1-2 I: distal spine scapula	**trapezius "posterior fibers"** O: w/ AT from L vert I: spine scapula		**spinotrapezius** O: ? I: posterior spine scapula		**trapezius posterior** O: last 6T I: posterior spine scapula	**trapezius posterior** O: last 2 T vert I: diist 1/3 scap spine
RHOMBOIDEUS CAPITIS	**rhomboideus** O: occipital crest + ligamentum nuchae I: vertebral border and caudal angle scapula	**rhomboids** O: ligamentum nuchae I: spine scapula + vertebral border scapula	**rhomboideus** O: occiput - T1 I: cranial surface + spine + vertebral border scapula	**r. occipital** O: occiput - T1 I: spine scapula + vertebral borde scapula		**r. capitis** O: occiput I: cranial surface spine scapula		**r. anticus** O: occipital crest, ligamentum nuchae, T1-5 I: base spine scapula	**r. capitis et cervicis** O: occipital crest, ligamentum nuchae 1T vert I: vertebral border scapula

	AFROSORICIDA								
	Tenrecidae								
	Potamogale **Dobson, 1883**	***Potamogale*** **Jullien, 1967**	***Potamogale*** **this work**	***Micropotamogale*** **Verheyen, 1961**	***Microgale*** **Dobson, 1882a**	***Microgale*** **this work**	***Setifer*** **Dobson, 1882**	***Tenrec*** **Dobson, 1882**	***Tenrec*** **Neveu + Gasc, 2002**
RHOMBOIDEUS CERVICIS									
RHOMBOIDEUS THORACIS						**r. cervicis et thoracis** O: C + T vertebrae I: vertebral border + caudal angle scapula		**r. posticus** O: T5-6 I: vertebral border scapula	**r. dorsi** O: 2-3T verts I: vertebral border scapula
OMOTRANSVERSARIUS "metacromion"		**acromio-trachélien** "did not see this"	**omotransversariu s** O: base occiput I: fibrous clavicle	**omocervicalis** O: atlas I: spine scapula		**omotransversariu s** O: atlas I: acromion		**levator scapulae** O: atlas I: tip acromion	**omotransversariu s** O: atlas I: metacromion
OMOTRANSVERSARIUS									
OMOHYOIDEUS	**omo-hyoid** O: hyoid I: cranial border scapula		**omohyoideus** O: hyoid I: cranial neck of scapula	**omohyoideus** O: hyoid I: cranial border of the scapula		**omohyoideus** ? I: cranial neck of scapula			

	AFROSORICIDA								
	Tenrecidae								
	Potamogale **Dobson, 1883**	***Potamogale*** **Jullien, 1967**	***Potamogale*** **this work**	***Micropotamogale*** **Verheyen, 1961**	***Microgale*** **Dobson, 1882a**	***Microgale*** **this work**	***Setifer*** **Dobson, 1882**	***Tenrec*** **Dobson, 1882**	***Tenrec*** **Neveu + Gasc, 2002**
SERRATUS VENTRALIS CERVICIS	**levator angulae scapulae** O: C4-6 I: w/ SVT near cranial angle scapula	**elévator de l'omoplate** I: deep vertebral border scapula	**serratus ventralis cervicis** O: C2-7 I: cranial + vertebral border of scapula	**serratus ventralis cervicis** O: C2-7 I: vertebral border scapula		**serratus ventralis cervicis** O: C2-7 I: vertebral border of scapula		**levator angulae scapulae** O: C4-6 I: w/ SVT near cranial angle scapula	**serratus ventralis cervicis** O: C3-7 I: deep surface vertebral border scapula
SERRATUS VENTRALIS THORACIS	**serratus magnus** O: ribs 1-9 I: w/ SVC near cranial angle scapula	**grand dentelé** O: 2 parts I: caudal angle scapula	**serratus ventralis thoracis** O: ribs via 3 digitations // rib 4? I: caudal angle scapula	**serratus ventralis thoracis** O: ribs 1-5, ribs 6-8 I: caudal angle scapula		**serratus ventralis thoracis** O: ribs via 3 digitations I: caudal angle of scapula		**serratus magnus** O: ribs 1-10 I: w/ SVC near cranial angle scapula	**serratus ventralis thoracis** O: ribs I: deep surface vertebral border scapula
CLAVODELTOIDEUS		**cléido-deltoïde** O: clavicle I: distal H	**clavodeltoideus** O: fibrous clavicle I: distal H			**clavodeltoideus** O: lateral clavicle I: w/ AD on lateral DP crest			**deltoideus pars clavicularis** O: lateral clavicle I: DP crest
ACROMIODELTOIDEUS		**acromio-deltoïde** "absent" , but see trapèze antérieur I: GT + H	**acromiodeltoideus** O: acromiotrapezius I: lateral DP crest			**acromiodeltoideus** O: acromion I: w/ CD on lateral DP crest			**deltoideus pars acromialis** O: acromion I: DP crest
SPINODELTOIDEUS	**deltoid** O: spine scapula, acromion I: proximal H	**spino-deltoïde** O: spine of scapula I: lateral DP crest	**spinodeltoideus** O: spine of scapula I: lateral DP crest	**spinodeltoideus** O: spine of scapula I: deltoid process H		**spinodeltoideus** O: spine of scapula I: lateral DP crest			**deltoideus pars spinalis** O: spine scapula I: DP crest

	AFROSORICIDA								
	Tenrecidae								
	Potamogale **Dobson, 1883**	***Potamogale*** **Jullien, 1967**	***Potamogale*** **this work**	***Micropotamogale*** **Verheyen, 1961**	***Microgale*** **Dobson, 1882a**	***Microgale*** **this work**	***Setifer*** **Dobson, 1882**	***Tenrec*** **Dobson, 1882**	***Tenrec*** **Neveu + Gasc, 2002**
TERES MINOR	**teres minor** absent	**petit rond** O: deep to infraspinatus I: distal GT	**teres minor** O : neck of scapula I: distal GT	**capsularis** O: LT I: deep surface scapula near glenoid		**teres minor** O: deep surface acromion I: distal GT			**teres minor** O: caudal border scapula I: lateral GT
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT	**sous-scapulaire** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT		**subscapularis** O: subscapular fossa I: LT			**subscapularis** O: subscapular fossa I: LT
TERES MAJOR	**teres major** I: medial H	**grand rond** O: caudal border scapula I: w/ LD on medial H	**teres major** O: caudal border scapula I: w/ LD on medial H	**teres major** O: caudal angle scapula I: teres tubercle w/ LD		**teres major** O: caudal edge subscapularis I: medial H			**teres major** O: caudal border scapula I: medial H
LATISSIMUS DORSI	**latissimus dorsi** O: all but proximal 4 T verts	**grand dorsal**	**latissimus dorsi** O: T + L1-5 verts	**latissimus dorsi** O: T3-L6		**latissimus dorsi** O: ?		**latissimus dorsi** ?	**latissimus dorsi** O: thoracolumbar fascia + ribs
"superficial"	I: w/ PS, medial bicipital groove	I: w/ TMA on medial H	I: w/ TMA on medial H	I: w/ TMA on H		I: medial H		I: w/ TMA medial H	I: proximal medial H
"deep"	* 2 insertions	I: w/ PA distal DP crest	I: w/ PP + S-S medial H	I: w/ PP on pectoral process		- (but see PC slips which ins w/ PP)			* another piece around BP
DORSO-EPITROCHLEARIS	**dorso-epitrochlearis** O: LD I: medial olecranon	**dorso-épitrochléo-olécrânien** O: LD I: medial olecranon	**dorso-epitrochlearis** O: LD I: medial olecranon	**dorso-epitrochlearis** O: LD I: olecranon		**dorso-epitrochlearis** O: LD I: medial olecranon	**dorso-epitrochlearis** O: LD I: medial olecranon	**dorso-epitrochlearis** O: LD I: medial olecranon	**dorso-epitrochlearis** O: LD I: medial olecranon

	AFROSORICIDA								
	Tenrecidae								
	Potamogale **Dobson, 1883**	***Potamogale*** **Jullien, 1967**	***Potamogale*** **this work**	***Micropotamogale*** **Verheyen, 1961**	***Microgale*** **Dobson, 1882a**	***Microgale*** **this work**	***Setifer*** **Dobson, 1882**	***Tenrec*** **Dobson, 1882**	***Tenrec*** **Neveu + Gasc, 2002**
PECTORALIS SUPERFICIALIS "clavicular"	**pectoralis major, anterior / clavicular part** O: ventral midline I: lateral H		**pectoralis superficialis, clavicular** O: ventral raphe I: distal DP crest	**pectoralis superficialis, anticus** O: hyoid + manubrium I: distal H		**pectoralis superficialis, clavicular** O: manubrium I: w/ PSs on distal DP crest		**pectoralis major, clavicular part** O: lateral clavicle I: w/ PSs distal half H	**pectoralis, clavicular** O: sternum I: DP ridge H
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis major, middle** O: sternum I: length of H	**grand pectoral, sternal** O: manubrium I: DP crest	**pectoralis superficialis, superficial** O: manubrium I: cranial H	**pectoralis superficialis, medius** O: sternum I: pectoral process H		**pectoralis superficialis, superficial** O: manubrium I: w/ PSc on distal DP crest	**pectoralis major, anterior** O: clavicle + sternum I: distal third H	**pectoralis major, anterior sternal** O: sternum + ventral raphe I: w/ PSc distal half H	**pectoralis, sternum** O: sternum I: DP ridge H
PECTORALIS SUPERFICIALIS "deep"		**grand pectoral, sternal** O: manubrium I: DP crest	**pectoralis superficialis, deep** O: sternum I: cranial H	**pectoralis superficialis, posticus** O: sternum I: pectoral process H		**pectoralis superficialis, deep** O: sternum I: cranial H		**pectoralis major, greater part "superficial"** O: sternum I: middle H	
PECTORALIS PROFUNDUS		**petit pectoral** O: sternum I: DP crest + LT	**pectoralis profundus** O: ventral midline I: GT, cranial H	**pectoralis profundus** O: sternum, ribs 2-10 I: H		**pectoralis profundus** O: ribs? I: cranial H		**pectoralis major, greater part "deep anterior"** O: sternum, ribs 1-6 I: GHj capsule	**pectoralis minor** O: sternum I: near H head
PECTORALIS ABDOMINALIS	**pectoralis major, posterior** O: ribs + aponeurosis of external oblique I: GHj capsule + H	**grand pectoral, abdominal** I: distal DP crest	**pectoralis abdominalis** O: lateral thorax I: cranial DP crest	**humero-abdominalis** O: w/ PSd, xiphisternum + abdomen		**pectoralis abdominalis** O: lateral thorax I: edge LT	**pectoralis major, posterior** O: aponeurosis of external oblique I: middle H	**pectoralis major, greater part "deep posterior"** O: aponeurosis of external oblique I: bicipital groove, w/ PC	O: sternum + rectus sheath I: DP ridge H

	AFROSORICIDA								
	Tenrecidae								
	Potamogale **Dobson, 1883**	***Potamogale*** **Jullien, 1967**	***Potamogale*** **this work**	***Micropotamogale*** **Verheyen, 1961**	***Microgale*** **Dobson, 1882a**	***Microgale*** **this work**	***Setifer*** **Dobson, 1882**	***Tenrec*** **Dobson, 1882**	***Tenrec*** **Neveu + Gasc, 2002**
SUBCLAVIUS		**sous-clavier** absent	**subclavius** absent	**subclavius**		**subclavius** absent		**subclavius** "absent"	**subclavius** absent
STERNOSCAPULARIS		**costo-scapulaire** absent	**sternoscapularis** O: w/ PP I: w/ PP medial GT, supraspinatus	**costoscapularis**	**subclavius** O: sternum + rib 1 I: lateral clavicle	**sternoscapularis** O: ? damaged I: craniolateral GT			
CORACOBRACHIALIS	**coraco-brachialis brevis** I: medial H	**coraco-brachial** O: coracoid process I: medial H	**coracobrachialis** O: medial supraglenoid tubercle I: medial H	**coraco-brachialis** O: coracoid process I: teres tuberosity		**coracobrachialis** O: coracoid process I: medial H	**coraco-brachialis longus et brevis** O: 2 heads, coracoid process I: medial condyle	**coraco-brachialis longus et brevis** O: 2 heads, coracoid process I: medial supracondylar bridge over entepicondylar foramen; w/TMA	**coracobrachialis superficialis** O: coracoid process I: medial H + epicondyle
CORACOBRACHIALIS									**coracobrachialis profundus** O: coracoid process I: near epiphysis H
BICEPS BRACHII, short head									

	AFROSORICIDA								
	Tenrecidae								
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BICEPS BRACHII, long head	**biceps** O: glenoid rim I: 2 parts, w/B U, R	**biceps** O: glenoid rim I: medial U + R	**long head biceps brachii** O: (lateral) supraglenoid tubercle I: medial U + neck R	**biceps brachii** O: glenoid I: U + R	**biceps** O: glenoid rim I: R	**long head biceps brachii** O: supraglenoid tubercle I: neck R	**biceps** O: glenoid rim I: 2 parts, U + R	**biceps** O: glenoid rim I: 2 parts, U + R	**biceps brachii** O: coracoid process I: R + U
BRACHIALIS	**brachialis anticus** O: caudal H I: w/BB in U	**brachial antérieur** O: lateral H I: medial U + R	**brachialis** O: distal to H head, medial + lateral heads I: medial U	**brachialis** O: caudal H near head I: U	**brachialis anticus** I: U	**brachialis** O: distal to H head I: medial U	**brachialis anticus** I: U	**brachialis anticus** I: U	**brachialis** O: lateral H I: U
? CUBITALIS ?						**cubitalis**			
SUPRASPINATUS	**supraspinatus** O: supraspinous fossa I: GT	**sus-épineux** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT		**supraspinatus** O: supraspinous fossa I: GT			**supraspinatus** O: supraspinous fossa I: GT
INFRASPINATUS	**infraspinatus** O: infraspinous fossa I: GT	**sous-**épineux O: infraspinous fossa I: fossa on lateral GT	**infraspinatus** O: infraspinous fossa I: distal GT	**infraspinatus** O: infraspinous fossa I: behind deltoid process		**infraspinatus** O: infraspinous fossa I: distal GT			**infraspinatus** O: infraspinous fossa I: lateral GT
TRICEPS BRACHII CAPUT LATERALE	**triceps, external** O: lateral H I: lateral olecranon	**triceps vaste externe** O: lateral H + neck I: w/ TLO olecranon	**triceps brachii caput laterale** O: lateral H I: lateral olecranon w / TLO	**triceps lateralis** O: lateral head H I: lateral olecranon		**triceps brachii caput laterale** O: lateral H I: lateral olecranon w/ TLO			**triceps, caput laterale** O: lateral DP crest I: olecranon

	AFROSORICIDA								
	Tenrecidae								
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TRICEPS BRACHII CAPUT MEDIALE	**triceps, posterior** O: caudal H I: cranial olecranon	**triceps vaste interne** O: medial to DP crest I: medial olecranon	**triceps brachii caput mediale** O: caudo-medial H I: medial 1/2 cranial olecranon	**triceps medius pars superficialis + pars profundus** O: caudal H near teres tuberosity I: cranial surface olecranon		**triceps brachii caput mediale** O: caudo-medial H I: cranial olecranon			**triceps, caput mediale** O: caudo-medial H I: olecranon
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps, scapular** O: caudal border scapula I: w/ TLO olecranon	**triceps long chef** O: caudal border scapula I: w/ TLA olecranon	**triceps brachii caput longum deep** O: caudal border + neck of scapula I: tip of olecranon + w/ TLA + TME	**triceps longus pars lateralis** O: caudal border scapula I: tip olecranon		**triceps brachii caput longum deep** O: caudal neck scapula I: w/ TLOs on tip olecranon			**triceps, caput longum** O: caudal border scapula I: olecranon
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)				**triceps longus pars medialis** O: caudal border scapula I: tip olecranon		**triceps brachii caput longum superficial** O: caudal neck scapula I: w/ TLOd on tip olecranon			
TRICEPS BRACHII ACCESSORY									
ANCONEUS		**epicondylo-cubital** - -	**anconeus** O: caudo-lateral H I: lateral 1/2 cranial surface olecranon	**anconeus lateralis** O: caudal surface lateral epicondyle I: lateral U		**anconeus** O: caudal lateral epicondyle I: lateral olecranon			**anconeus lateralis** O: caudal lateral epicondyle I: lateral olecranon
BRACHIORADIALIS	**supinator longus** absent	**brachio-radial**	**brachioradialis** absent			**brachioradialis** absent		**supinator longus** absent	

	AFROSORICIDA								
	Tenrecidae								
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EXT CARPI RADIALIS, longus (MC2)		**extenseur radial du carpe** O: lateral supracondylar crest I: base MC2 + 3	**ext carpi radialis** O: lateral supracondylar crest I: base MC2 + 3	**ext carpi radialis** O: lateral supracondylar ridge I: MC2 + MC3		**ext carpi radialis longus** O: lateral supracondylar ridge I: base MC2		**ext carpi radialis** O: lateral supracondylar crest I: base MC2 + 3	**ext carpi radialis longus et brevis** O: lateral supracondylar crest I: base MC2 + 3
EXT CARPI RADIALIS, brevis (MC3)						**ext carpi radialis brevis** O: lateral supracondylar ridge I: base MC3			
EXT DIGITORUM COMMUNIS		**extenseur commun des doigts** O: lateral supracondylar crest I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5		**ext digitorum communis** O: EDL I: digits 2, 3, 4		**ext digitorum communis** O: w/ EDL lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5
EXT DIGITORUM LATERALIS		**extenseur du V** O: lateral epicondyle I: digits 4, 5	**ext digitorum lateralis** O: lateral epicondyle I: digits 4, 5	**ext digiti quinti** O: lateral epicondyle I: digits 4, 5		**ext digitorum lateralis** O: lateral epicondyle I: lateral digit 3, 4, center digit 5		**ext minimi digiti** O: w/ EDC I: digits 4, 5	**ext digitorum lateralis** O: lateral epicondyle I: digits 4, 5
EXT CARPI ULNARIS		**extenseur cubital du carpe** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I : base MC5	**ext carpi ulnaris** O: lateral epicondyle I : MC5		**ext carpi ulnaris** O: lateral epicondyle I: base MC5		**ext carpi ulnaris** O: lateral epicondyle + U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5
SUPINATOR	**supinator brevis** O: lateral epicondyle I: proximal R	**supinateur**	**supinator** O: cranial surface lateral epicondyle I: into APL	**supinator** O: lateral epicondyle I: cranial R		**supinator** O: cranial surface lateral epicondyle I: cranial R		**supinator brevis** O: lateral epicondyle I: middle R	**supinator** O: lateral epicondylar ridge I: proximal R

	AFROSORICIDA								
	Tenrecidae								
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ABD POLLICIS LONGUS		**long abducteur du pouce** O: lateral U + R I: MC1	**abd pollicis longus** O: lateral U + lateral R head I: base MC1, radial sesamoid	**abd pollicis longus** O: lateral U I: MC1		**abd pollicis longus** O: lateral epicondyle + lateral U I: base MC1		**extensor ossis metacarpi pollicis** O: lateral U I: base MC1	**abductor pollicis longus** O: R + U I: base MC1
EXT DIGITORUM PROFUNDUS		**extenseur profond des doigts** O: lateral olecranon I: digits 1, 2	**ext digitorum profundus** O: lateral U I: center digit 1, medial digit 2	**ext indicis et pollicis longus** O: lateral U I: digits 1, 2, 3		**ext digitorum profundus** O: lateral U I: medial digit 1, 2		**ext secundi internodii pollicis et extensor indicis** O: U I: digits 1 + 2	**ext digitorum profundus** O: U I: digits 1 + 2
EXT BREVIS DIGITORUM									
PRONATOR TERES	**pronator radii teres** O: medial epicondyle I: distal R	**rond pronateur** O: medial epicondyle I: cranial R	**pronator teres** O: medial epicondyle I: cranial R	**pronator teres** O: medial epicondyle I: cranial R		**pronator teres** O: medial epicondyle I: cranial R	**pronator radii teres** O: medial epicondyle I: middle R	**pronator radii teres** O: medial epicondyle I: middle R	**pronator teres** O: medial epicondyle I: cranio-medial R
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: base MC2	**fléchisseur radial du carpe** O: medial epicondyle I: palmar base MC3	**flx carpi radialis** O: medial epicondyle I: palmar base MC2	**flx carpi radialis** O: medial epicondyle I: proximal MC2+3		**flx carpi radialis** O: medial epicondyle I: palmar base MC2			**flx carpi radialis** O: medial epicondyle I: base MC2
PALMARIS LONGUS	**palmaris longus** O: medial epicondyle I: base of palmar callosity	**long palmaire** O: medial epicondyle w/ FDP I: MC1 + 5	**palmaris longus** O: medial epicondyle w/ FDPe I: palmar aponeurosis + flexor retinaculum	**palmaris longus** O: medial epicondyle w/ FDPe I: fascia of palm, digit 5		**palmaris longus** O: FCUe I: palmar aponeurosis	**palmaris longus** O: medial epicondyle w/ FDPe + FCU	**palmaris longus** O: medial epicondyle w/ FDPe + FCU	**palmaris longus** O: medial epicondyle I: superficial palmar fascia

	AFROSORICIDA								
	Tenrecidae								
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FLX DIGITORUM SUPERFICIALIS	**flexor sublimis** O: medial epicondyle I: digits 1, 2, 3, 4, 5	**fléchisseur superficiel des doigts** O: w/ FDPe -	**flx digitorum superficialis** O: FDPe I: MCPj dig 3	**flx digitorum sublimis** O: medial epicondyle I: digits 2, 3, 4		**flx digitorum superficialis** O: caudal surface medial epicondyle w/ FDPd I: digits 2, 3, 4	**flx digitorum sublmis** O: medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum sublmis** O: medial epicondyle I: digits 2f, 3f, 4f	**flexor digitorum superficialis** O: medial epicondyle I: digits 2f, 3f, 4f
INTERFLEXORII					absent		present	present	
FLX DIGITORUM PROFUNDUS,	**flexor profundus digitorum**	**fléchisseur profond des doigts, superficiel**	**flx digitorum profundus**	**flx digitorum profundus**		**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**
epicondylar									
epicondylar (FDPe)	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle I: conjoined F	O: medial epicondyle		O: medial epicondyle I: medial edge of conjoined F	O: medial epicondyle	O: medial epicondyle	
epicondylar (FDPd)	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle		O: caudal surface medial epicondyle w/ FDS	O: medial epicondyle	O: medial epicondyle	
			I: medial edge conjoined F	I: conjoined F		I: conjoined F			
ulnar	O: U	O: U	O: caudal + medial U I: conjoined F	O: caudal + medial U I: lateral edge conjoined F		O: caudal + medial U I: conjoined F	O: U	O: U	O: U
radial	O: U		O: medial R I: conjoined F				O: R	O: R	O: R
	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5		*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5
LUMBRICALES	**lumbricales** O: FDP I: digits 3, 4, 5	**lombricaux** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: medial digits 2, 3, 4, 5	**lumbricales** O: FDP I: medial digits 2, 3, 4, 5		**lumbricales** O: FDP I: medial digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales manus** O: FDP I: digits 2, 3, 4, 5

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	Tenrecidae								
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FLX CARPI ULNARIS,	**flx carpi ulnaris**	**fléchisseur cubital du carpe**	**flx carpi ulnaris**	**flx carpi ulnaris**		**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**
epitrochlear belly	O: medial epicondyle		-	O: medial epicondyle		O: FDPe + medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle
ulnar belly	O: medial olecranon I: pisiform	O: medial olecranon I: pisiform	O: medial olecranon + U I: pisiform	O: medial olecranon I: pisiform		O: medial olecranon I: pisiform			O: medial olecranon I: pisiform
EPITROCHLEO-ANCONEUS		**épitrochléo-olécrânien** O: medial epicondyle I: medial olecranon	**epitrochleo-anconeus** O: caudal medial epicondyle I: medial olecranon	**epitrochleo-anconeus** O: medial epicondyle I: medial olecranon		**epitrochleo-anconeus** O: caudal medial epicondyle I: medial olecranon			**anconeus medialis** O: caudal medial epicondyle I: medial olecranon
PRONATOR QUADRATUS		**carré pronateur**	**pronator quadratus** O: middle 1/3 R + U	**pronator quadratus** O: R + U		**pronator quadratus** O: proximal 1/3 R + U			**pronator quadratus** O: interosseus space
PALMARIS BREVIS		**court palmaire** absent	**palmaris brevis** ? Large hypothenar pad muscle			**palmaris brevis** absent			
FLX DIGITORUM BREVIS MANUS		**court fléchisseur des doigts de la main** ? I: digit 4	**flexor digitorum breves manus** O: flexor retinaculum I: digits 2, 4, 5	**flx brevis digitorum manus** O: palmaris longus I: digit 4		**flexor digitorum breves manus** O carpus + flexor retinaculum I: digits 1, 4, 5			**flexor digitorum brevis manus** O: palmar aponeurosis I: digits 4 + 5
ABD DIGITI MINIMI		**abducteur du V** O: pisiform I: digit 5	**abd digiti minimi** O: pisiform I: MC5	**abd digiti quinti** O: pisiform I: ulnar sesamoid		**abd digiti minimi** O: pisiform I: MC5			**abd minimi digiti** O: pisiform + annular ligament I: digit 5

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	Tenrecidae								
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ABD POLLICIS BREVIS		**abducteur du I** O: trapezium I: digit 1	**abd pollicis brevis** - -	**abd pollicis brevis** O: carpals - triquetrum I: radial sesamoid		**abd pollicis brevis** - -			**abd pollicis brevis** O: trapezium I: digit 1
CONTRAHENTES	**adductors** I: digits 1, 2, 5	**contracteurs des doigts** O: carpus I: digits 1, 2, 5	**contrahentes** O: carpus I: digits 1, 2, 5	**contrahentes** O: trapezoid, hamate, capitulum I: digits 1, 2, 5	**adductors** I: digits 1 + 5	**contrahentes** O: carpus I: digits 1, 5	**adductors** I: digits 1 + 5	**adductors** I: digits 1, 2, 5	
FLEXOR BREVES PROFUNDUS	**flexores breves** 10	**muscles interosseux** 10 O: fibrous sheet	**flexor breves profundus** 10 O: fibrous sheet	**flexores breves profundi** 10		**flexor breves profundus** 10 O: fibrous sheet	**flexores breves vel interossei** 10	**flexores breves vel interossei** 10	**interossei palmares** 10
INTERMETACARPALES			**intermetacarpales** -			**intermetacarpales** -			
? Unknown homology									
RADIAL SESAMOID "PRE-POLLUX"			present, vestigial	present		present		present	
ULNAR SESAMOID			absent	present		absent		present	
CARPAL VIBRISSAE						present			

	MACROSCELIDEA							
	Macroscelididae							
	Elephantulus **Jullien, 1967**	***Elephantulus*** **this work**	***Elephantulus*** **Haines, 1955**	***Macroscelides*** **Jullien, 1967**	***Petrodromus*** **this work**	***Petrodromus*** **Jullien, 1967**	***Rhynchocyon*** **Jullien, 1967**	***Rhynchocyon*** **this work**
PANNICULUS CARNOSUS		**panniculus carnosus** O: back + sides I: fascia posterior axilla			**panniculus carnosus** O: back + sides I: fascia posterior axilla, slips to pectorals			**panniculus carnosus** O: back + sides I: metacromion, slip to PS
STERNO-FACIALIS								
STERNOMASTOIDEUS	**sterno-mastoïdien** O: mastoid process I: manubrium	**sternomastoideus** O: mastoid process I: manubrium		**sterno-mastoïdien** O: mastoid process I: manubrium	**sternomastoideus** O: mastoid process I: manubrium	**sterno-mastoïdien** O: mastoid process I: manubrium	**sterno-mastoïdien** O: mastoid process I: manubrium	**sternomastoideus** O: mastoid process I: manubrium + sternum
CLEIDOMASTOIDEUS	**cleido-mastoïdien** O: mastoid process I: manubrium	**cleidomastoideus** O: mastoid process I: medial clavicle		**cleido-mastoïdien** O: mastoid process I: manubrium	**cleidomastoideus** O: mastoid process I: medial clavicle + manubrium	**cleido-mastoïdien** O: mastoid process I: manubrium	**cleido-mastoïdien** O: mastoid process I: manubrium	**cleidomastoideus** O: mastoid process I: medial clavicle
CLAVOTRAPEZIUS	**cleido-occipital** O: occipital crest I: medial clavicle	**clavotrapezius** O: occiput I: lateral clavicle		**cleido-occipital** O: occipital crest w/ AT I: medial clavicle	**clavotrapezius** O: occipital crest I: medial clavicle	**cleido-occipital** O: occipital crest I: medial clavicle	**cleido-occipital** O: edge AT I: medial clavicle	**clavotrapezius** O: occiput I: lateral clavicle * slip to pinna
CEPHALOHUMERALIS	SM superficial to PS	-						-

	MACROSCELIDEA							
	Macroscelididae							
	Elephantulus Jullien, 1967	*Elephantulus* this work	*Elephantulus* Haines, 1955	*Macroscelides* Jullien, 1967	*Petrodromus* this work	*Petrodromus* Jullien, 1967	*Rhynchocyon* Jullien, 1967	*Rhynchocyon* this work
ACROMIOTRAPEZIUS	**trapèze antérieur** O: C verts I: spine scapula + metacromion * bifid	**acromiotrapezius** O: ligamentum nuchae + proximal T vert I: spine scapula + metacromion * bifid		**trapèze antérieur** O: occipital crest + C verts I: spine scapula + metacromion * bifid	**acromiotrapezius** O: occiput + ligamentum nuchae I: spine scapula + metacromion * bifid	**trapèze antérieur** O: occipital crest + C verts I: spine scapula + metacromion * bifid	**trapèze antérieur** O: C verts I: spine scapula + metacromion * bifid	**acromiotrapezius** O: ligamentum nuchae + proximal T vert I: spine scapula + metacromion * bifid
INTERMEDIATE TRAPEZIUS / DORSO-CUTANEUS	**une lame charnue** O: C verts I: base spine scapula	**intermediate trapezius** O: several T verts I: vertebral border scapula		**une lame charnue** O: C verts I: base spine scapula	**intermediate trapezius** O: caudal ligamentum nucahe I: vertebral border scapula	**une lame charnue** O: C verts I: base spine scapula	**une lame charnue** O: C verts I: w/ AT	**intermediate trapezius** O: several T verts I: edge spinotrapezius
SPINOTRAPEZIUS	**trapezius postérieur** O: L1 I: base spine scapula	**spinotrapezius** O: L1 I: base spine scapula		**trapezius postérieur** O: L1 I: base spine scapula	**spinotrapezius** O: L1 I: medial spine scapula	**trapezius postérieur** O: L1 I: base spine scapula	**trapezius postérieur** O: L1 I: base spine scapula	**spinotrapezius** O: thoracolumbar fascia + L1 I: base spine scapula
RHOMBOIDEUS CAPITIS	**r. occipital** O: occiput I: vertebral border scapula	**r. capitis** O: occiput I: vertebral border scapula		**r. occipital** O: occiput I: vertebral border scapula	**r. capitis** O: occiput I: vertebral border scapula	**r. occipital** O: occiput I: vertebral border scapula	**r. occipital** O: occiput I: vertebral border scapula	**r. capitis** O: occiput I: w/ RC
RHOMBOIDEUS CERVICIS	**r. cervical** O: C verts I: vertebral border + caudal angle scapula	**r. cervicis** O: C + T verts I: vertebral border scapula		**r. cervical** O: C verts I: vertebral border + caudal angle scapula	**r. cervicis** O: C verts I: vertebral border scapula	**r. cervical** O: C verts I: vertebral border + caudal angle scapula	**r. cervical** O: C verts I: vertebral border + caudal angle scapula	**r. cervicis** O: C verts I: vertebral border scapula

	MACROSCELIDEA							
	Macroscelididae							
	Elephantulus **Jullien, 1967**	***Elephantulus*** **this work**	***Elephantulus*** **Haines, 1955**	***Macroscelides*** **Jullien, 1967**	***Petrodromus*** **this work**	***Petrodromus*** **Jullien, 1967**	***Rhynchocyon*** **Jullien, 1967**	***Rhynchocyon*** **this work**
RHOMBOIDEUS THORACIS	**r. dorsal** O: T verts I: caudal angle scapula	**r. thoracis** O: T verts I: caudal angle scapula		**r. dorsal** O: T verts I: caudal angle scapula	**r. thoracis** O: 3T verts I: vertebral border scapula	**r. dorsal** O: T verts I: caudal angle scapula	**r. dorsal** O: T verts I: caudal angle scapula	**r. thoracis** O: T verts I: caudal angle scapula
OMOTRANSVERSARIUS "metacromion"	**acromio-trachélien** O: atlas I: tip metacromion	**omotransversarius** O: atlas I: tip metacromion		**acromio-trachélien** O: atlas I: tip metacromion	**omotransversarius** O: atlas I: tip metacromion	**acromio-trachélien** O: atlas I: tip metacromion	**acromio-trachélien** O: atlas I: tip metacromion * superficial to CT	**omotransversarius** O: atlas I: tip metacromion * superficial to CT
OMOTRANSVERSARIUS								
OMOHYOIDEUS		**omohyoideus** absent			**omohyoideus** absent			**omohyoideus** absent
SERRATUS VENTRALIS CERVICIS	**elévator de l'omoplate** I: vertebral border scapula	**serratus ventralis cervicis** O: C verts I: w/ SVT on cranial angle and vertebral border scapula		**elévator de l'omoplate** I: vertebral border scapula	**serratus ventralis cervicis** O: C verts I: w/ SVT on cranial angle and vertebral border scapula	**elévator de l'omoplate** I: vertebral border scapula	**elévator de l'omoplate** I: vertebral border scapula	**serratus ventralis cervicis** O: C vertebrae I: w/ SVT on cranial angle and vertebral border scapula

	MACROSCELIDEA							
	Macroscelididae							
	Elephantulus **Jullien, 1967**	***Elephantulus*** **this work**	***Elephantulus*** **Haines, 1955**	***Macroscelides*** **Jullien, 1967**	***Petrodromus*** **this work**	***Petrodromus*** **Jullien, 1967**	***Rhynchocyon*** **Jullien, 1967**	***Rhynchocyon*** **this work**
SERRATUS VENTRALIS THORACIS	**grand dentelé** O: ribs via 7-8 digitations I: caudal angle + vertebral border scapula	**serratus ventralis thoracis** O: ribs via 4 digitations I: w/ SVC on cranial angle and vertebral border		**grand dentelé** O: ribs via 7-8 digitations I: caudal angle + vertebral border scapula	**serratus ventralis thoracis** O: ribs via 4 digitations I: caudal angle scapula	**grand dentelé** O: ribs via 7-8 digitations I: caudal angle + vertebral border scapula	**grand dentelé** O: ribs via 9 straps I: caudal angle scapula	**serratus ventralis thoracis** O: ribs via 5 digitations I: w/ SVC on cranial angle and vertebral border
CLAVODELTOIDEUS	**cléido-deltoïde** O: clavicle	**clavodeltoideus** O: clavicle I: w/ AD on lateral DP crest of H		**cléido-deltoïde** O: clavicle	**clavodeltoideus** O: clavicle I: lateral DP crest of H	**cléido-deltoïde** O: clavicle	**cléido-deltoïde** O: clavicle	**clavodeltoideus** O: clavicle I: w/ AD on lateral DP crest of H
ACROMIODELTOIDEUS	**acromio-deltoïde** O: acromion	**acromiodeltoideus** O: acromion I: w/ CD on lateral DP crest of H		**acromio-deltoïde** O: acromion	**acromiodeltoideus** O: acromion I: lateral DP crest of H	**acromio-deltoïde** O: acromion	**acromio-deltoïde** O: acromion	**acromiodeltoideus** O: acromion I: w/ CD on lateral DP crest of H
SPINODELTOIDEUS	**spino-deltoïde** O: spine scapula, infraspinous fossa	**spinodeltoideus** O: spine scapula I: lateral to A-CD on DP crest		**spino-deltoïde** O: spine scapula, infraspinous fossa	**spinodeltoideus** O: spine scapula I: lateral to AD on DP crest	**spino-deltoïde** O: spine scapula, infraspinous fossa	**spino-deltoïde** O: spine scapula, infraspinous fossa	**spinodeltoideus** O: proximal 1/2 spine scapula I: lateral to A-CD on DP crest
TERES MINOR	**petit rond** O: caudal neck of scapula I: distal GT	**teres minor** O: caudal border scapula I: distal GT		**petit rond** O: caudal neck of scapula I: distal GT	**teres minor** O: fascia of IN I: fossa distal GT	**petit rond** O: caudal neck of scapula I: distal GT	**petit rond** O: caudal neck of scapula I: distal GT	**teres minor** O: fascia of IN, caudal neck of scapula I: distal GT
SUBSCAPULARIS	**sous-scapulaire** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: fossa on LT		**sous-scapulaire** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: fossa on LT	**sous-scapulaire** O: subscapular fossa I: LT	**sous-scapulaire** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: fossa on LT

	MACROSCELIDEA							
	Macroscelididae							
	Elephantulus **Jullien, 1967**	***Elephantulus*** **this work**	***Elephantulus*** **Haines, 1955**	***Macroscelides*** **Jullien, 1967**	***Petrodromus*** **this work**	***Petrodromus*** **Jullien, 1967**	***Rhynchocyon*** **Jullien, 1967**	***Rhynchocyon*** **this work**
TERES MAJOR	**grand rond** O: caudal border scapula I: medial H w/ LD	**teres major** O: caudal angle + border scapula I: medial H w/ LD		**grand rond** O: caudal border scapula I: medial H w/ LD	**teres major** O: caudal angle + border scapula I: medial H w/ LD	**grand rond** O: caudal border scapula I: medial H w/ LD	**grand rond** O: caudal border scapula I: medial H	**teres major** O: caudal angle scapula I: medial DP crest
LATISSIMUS DORSI "superficial" "deep"	**grand dorsal** O: last T + L1 vert I: medial H w/ TMA	**latissimus dorsi** O: T + L1 verts, thoracolumbar fascia I: medial H w/ TMA		**grand dorsal** O: last T + L1 vert I: medial H w/ TMA	**latissimus dorsi** O: 4 T + L verts I: medial H w/ TMA	**grand dorsal** O: last T + L1 vert I: medial H w/ TMA	**grand dorsal** O: last T + L1 vert I: medial H	**latissimus dorsi** O: T + L1 verts, thoracolumbar fascia I: medial DP crest
DORSO-EPITROCHLEARIS	**dorso-épitrochléo-olécrânien** O: LD I: caudo-medial olecranon	**dorso-epitrochlearis** O: LD I: medial olecranon		**dorso-épitrochléo-olécrânien** O: LD I: caudo-medial olecranon	**dorso-epitrochlearis** O: TMA + LD I: medial olecranon	**dorso-épitrochléo-olécrânien** O: TMA I: caudo-medial olecranon	**dorso-épitrochléo-olécrânien** O: TMA + LD I: caudo-medial olecranon	**dorso-epitrochlearis** O: LD I: medial olecranon
PECTORALIS SUPERFICIALIS "clavicular"								
PECTORALIS SUPERFICIALIS "superficial"	**grand pectoral, sternal, anterieure** O: manubrium + sternebrae I: distal DP crest	**pectoralis superficialis** O: sternum I: medial DP crest		**grand pectoral, sternal, anterieure** O: manubrium + sternebrae I: distal DP crest	**pectoralis superficialis** O: sternum I: medial DP crest	**grand pectoral, sternal, anterieure** O: manubrium + sternebrae I: distal DP crest	**grand pectoral, sternal, anterieure** O: manubrium + sternebrae I: DP crest	**pectoralis superficialis** O: clavicle + manubrium I: DP crest medial to deltoids

	MACROSCELIDEA							
	Macroscelididae							
	Elephantulus **Jullien, 1967**	***Elephantulus*** **this work**	***Elephantulus*** **Haines, 1955**	***Macroscelides*** **Jullien, 1967**	***Petrodromus*** **this work**	***Petrodromus*** **Jullien, 1967**	***Rhynchocyon*** **Jullien, 1967**	***Rhynchocyon*** **this work**
PECTORALIS SUPERFICIALIS "deep"								
PECTORALIS PROFUNDUS	**grand pectoral, sternal, posterieure** O: sternebrae I: proximal DP crest	**pectoralis profundus** O: ventral midline I: medial distal GT		**grand pectoral, sternal, posterieure** O: sternebrae I: proximal DP crest	**pectoralis profundus** O: ventral midline I: distal GT	**grand pectoral, sternal, posterieure** O: sternebrae I: proximal DP crest	**grand pectoral, sternal, posterieure** O: sternebrae I: GT	**pectoralis profundus** O: sternum I: w/ PA on medial GT
PECTORALIS ABDOMINALIS	**grand pectoral, abdominal** absent	**pectoralis abdominalis** O: lateral thorax I: cranial H		**grand pectoral, abdominal** absent	**pectoralis abdominalis** O: fascia over SV I: cranial H + fascial sac	**grand pectoral, abdominal** O: lateral thorax I: proximal DP crest	**grand pectoral, abdominal** O: lateral thorax I: proximal DP crest	**pectoralis abdominalis** O: fascia over SV I: w/ PP on medial GT
SUBCLAVIUS	**sous-clavier** O: costal cartilage 1 I: lateral clavicle	**subclavius** O: rib 1 I: lateral clavicle		**sous-clavier** O: costal cartilage 1 I: lateral clavicle	**subclavius** O: rib 1 I: lateral clavicle	**sous-clavier** O: costal cartilage 1 I: lateral clavicle	**sous-clavier** O: costal cartilage 1 I: lateral clavicle	**subclavius** O: ligamentous fibers off sternoscapularis I: clavicle
STERNOSCAPULARIS	**costo-scapulaire** O: lateral clavicle I: acromion + cranial border scapula	**cleidoscapularis** O: lateral clavicle I: acromion + spine of scapula		**costo-scapulaire** O: lateral clavicle I: acromion + cranial border scapula	**cleidoscapularis** O: lateral clavicle I: acromion + cranial border scapula	**costo-scapulaire** O: lateral clavicle I: acromion + cranial border scapula	**costo-scapulaire** O: thorax I: acromion + spine of scapula	**sternoscapularis** O: sternum I: fascia over S
CORACOBRACHIALIS	**coraco-brachial** - -	**coracobrachialis** O: medial coracoid process I: w/BBs, distal H		**coraco-brachial** - -	**coracobrachialis** O: medial coracoid process I: distal medial H	**coraco-brachial** - -	**coraco-brachial** - -	**coracobrachialis** O: medial coracoid process I: w/ BBs, then distal medial H

	MACROSCELIDEA							
	Macroscelididae							
	Elephantulus **Jullien, 1967**	***Elephantulus*** **this work**	***Elephantulus*** **Haines, 1955**	***Macroscelides*** **Jullien, 1967**	***Petrodromus*** **this work**	***Petrodromus*** **Jullien, 1967**	***Rhynchocyon*** **Jullien, 1967**	***Rhynchocyon*** **this work**
CORACOBRACHIALIS								
BICEPS BRACHII, short head	**biceps, coraco-radial** O: ventral tip coracoid I: cranial R	**short head biceps brachii** O: lateral coracoid process I: R neck		**biceps, coraco-radial** O: ventral tip coracoid I: cranial R	**short head biceps brachii** O: lateral coracoid process I: neck R	**biceps, coraco-radial**	**biceps, coraco-radial** O: ventral tip coracoid I: cranial R	**short head biceps brachii** O: lateral coracoid process I: medial R
BICEPS BRACHII, long head	**biceps, gléno-cubital** O: glenoid rim near coracoid I: depression on medial U	**long head biceps brachii** O: supraglenoid tubercle I: medial U		**biceps, gléno-cubital** O: glenoid rim near coracoid I: depression on medial U	**long head biceps brachii** O: supraglenoid tubercle I: medial U	**biceps, gléno-cubital**	**biceps, gléno-cubital** O: glenoid rim near coracoid I: depression on medial U	**long head biceps brachii** O: supraglenoid tubercle I: fossa near coronoid process U
BRACHIALIS	**brachial antérieur** O: lateral DP crest I: medial U	**brachialis** O: distal to H head I: medial U		**brachial antérieur**	**brachialis** O: distal to H head I: medial U	**brachial antérieur**	**brachial antérieur**	**brachialis** O: distal to head H I: base of coronoid process U
? CUBITALIS ?								
SUPRASPINATUS	**sus-épineux** O: supraspinous fossa I: top GT	**supraspinatus** O: supraspinous fossa I: top GT		**sus-épineux** O: supraspinous fossa I: top GT	**supraspinatus** O: supraspinous fossa I: top GT	**sus-épineux** O: supraspinous fossa I: top GT	**sus-épineux** O: supraspinous fossa I: top GT	**supraspinatus** O: supraspinous fossa I: top GT

	MACROSCELIDEA							
	Macroscelididae							
	Elephantulus **Jullien, 1967**	***Elephantulus*** **this work**	***Elephantulus*** **Haines, 1955**	***Macroscelides*** **Jullien, 1967**	***Petrodromus*** **this work**	***Petrodromus*** **Jullien, 1967**	***Rhynchocyon*** **Jullien, 1967**	***Rhynchocyon*** **this work**
INFRASPINATUS	**sous-épineux** O: infraspinous fossa I: fossa on GT	**infraspinatus** O: infraspinous fossa I: fossa on GT		**sous-épineux** O: infraspinous fossa I: fossa on GT	**infraspinatus** O: infraspinous fossa I: GT	**sous-épineux** O: infraspinous fossa I: fossa on GT	**sous-épineux** O: infraspinous fossa I: fossa on GT	**infraspinatus** O: infraspinous fossa I: fossa on GT
TRICEPS BRACHII CAPUT LATERALE	**triceps vaste externe** O: lateral H + neck I: w/ TLO olecranon	**triceps brachii caput laterale** O: distal to H head I: w/ TLO on caudo-lateral olecranon		**triceps vaste externe** O: lateral H + neck I: w/ TLO olecranon	**triceps brachii caput laterale** O: lateral H + neck I: w/ TLO lateral olecranon	**triceps vaste externe** O: lateral H + neck I: w/ TLO olecranon	**triceps vaste externe** O: lateral H + neck I: w/ TLO olecranon	**triceps brachii caput laterale** O: distal to H head I: lateral prox U
TRICEPS BRACHII CAPUT MEDIALE	**triceps vaste interne** O: medial to DP crest I: medial olecranon	**triceps brachii caput mediale** O: medial H I: medial 1/2 cranial olecranon		**triceps vaste interne** O: medial to DP crest I: medial olecranon	**triceps brachii caput mediale** O: caudo-medial H I: medial 1/2 cranial olecranon	**triceps vaste interne** O: medial to DP crest I: medial olecranon	**triceps vaste interne** O: medial to DP crest I: medial olecranon	**triceps brachii caput mediale** O: medial H I: medial 1/2 cranial olecranon
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps long chef** O: caudal border scapula I: w/ TLA olecranon	**triceps brachii caput longum deep** O: neck of scap I: w/ TLOs on tip of olecranon		**triceps long chef** O: caudal border scapula I: w/ TLA olecranon	**triceps brachii caput longum deep** O: neck scapula I: w/ TLOs olecranon	**triceps long chef** O: caudal border scapula I: w/ TLA olecranon	**triceps long chef** O: caudal border scapula I: w/ TLA olecranon	**triceps brachii caput longum deep** O: neck of scap I: tip of olecranon
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)	**triceps long chef** O: caudal border scapula I: w/ TLA olecranon	**triceps brachii caput longum superficial** O: neck of scap I: w/ TLOd on tip of olecranon		**triceps long chef** O: caudal border scapula I: w/ TLA olecranon	**triceps brachii caput longum superficial** O: caudal border scapula I: w/ TLOd olecranon	**triceps long chef** O: caudal border scapula I: w/ TLA olecranon	**triceps long chef** O: caudal border scapula I: w/ TLA olecranon	**triceps brachii caput longum superficial** O: neck of scapula I: tip of olecranon
TRICEPS BRACHII ACCESSORY		- -		- -	- -	- -	- -	- -

	MACROSCELIDEA							
	Macroscelididae							
	Elephantulus **Jullien, 1967**	***Elephantulus*** **this work**	***Elephantulus*** **Haines, 1955**	***Macroscelides*** **Jullien, 1967**	***Petrodromus*** **this work**	***Petrodromus*** **Jullien, 1967**	***Rhynchocyon*** **Jullien, 1967**	***Rhynchocyon*** **this work**
ANCONEUS	**epicondylo-cubital** "rudimentary"	**anconeus** O: caudo-lateral H I: lateral 1/2 cranial olecranon		**epicondylo-cubital** "rudimentary"	**anconeus** O: caudal lateral epicondyle I: lateral olecranon	**epicondylo-cubital** "rudimentary"	**epicondylo-cubital** "rudimentary"	**anconeus** O: caudo-lateral H I: lateral 1/2 cranial olecranon
BRACHIORADIALIS	**brachio-radial** absent	**brachioradialis** absent		**brachio-radial** absent	**brachioradialis** absent	**brachio-radial** absent	**brachio-radial** absent	**brachioradialis** absent
EXT CARPI RADIALIS, longus (MC2)	**extenseur radial du carpe** O: lateral supracondylar crest I: w/ ECRb on base MC2 + MC3	**ext carpi radialis longus** O: lateral supracondylar crest I: w/ ECRb on base MC2 + MC3		**extenseur radial du carpe** O: lateral supracondylar crest I: w/ ECRb on base MC2 + MC3	**ext carpi radialis longus** O: lateral supracondylar crest I: w/ ECRb on base MC2 + MC3	**extenseur radial du carpe** O: lateral supracondylar crest I: w/ ECRb on base MC2 + MC3	**extenseur radial du carpe** O: lateral supracondylar crest I: w/ ECRb on base MC2 + MC3	**ext carpi radialis longus** O: lateral supracondylar crest I: w/ ECRb on base MC2 + MC3
EXT CARPI RADIALIS, brevis (MC3)	**extenseur radial du carpe** O: w/ EDC lateral epicondyle I: w/ ECRl on base MC2 + MC3	**ext carpi radialis brevis** O: cranial surface distal lateral H I: w/ ECRl on base MC2 + MC3		**extenseur radial du carpe** O: w/ EDC lateral epicondyle I: w/ ECRl on base MC2 + MC3	**ext carpi radialis brevis** O: w/ EDC lateral epicondyle I: w/ ECRl on base MC2 + MC3	**extenseur radial du carpe** O: w/ EDC lateral epicondyle I: w/ ECRl on base MC2 + MC3	**extenseur radial du carpe** O: w/ EDC lateral epicondyle I: w/ ECRl on base MC2 + MC3	**ext carpi radialis brevis** O: cranial surface distal lateral H I: w/ ECRl on base MC2 + MC3
EXT DIGITORUM COMMUNIS	**extenseur commun des doigts** O: lateral supracondylar crest I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5		**extenseur commun des doigts** O: lateral supracondylar crest I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**extenseur commun des doigts** O: lateral supracondylar crest I: digits 2, 3, 4, 5	**extenseur commun des doigts** O: lateral supracondylar crest I: digits 2, 3, 4	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4

	MACROSCELIDEA							
	Macroscelididae							
	Elephantulus **Jullien, 1967**	***Elephantulus*** **this work**	***Elephantulus*** **Haines, 1955**	***Macroscelides*** **Jullien, 1967**	***Petrodromus*** **this work**	***Petrodromus*** **Jullien, 1967**	***Rhynchocyon*** **Jullien, 1967**	***Rhynchocyon*** **this work**
EXT DIGITORUM LATERALIS	**extenseur du V** O: lateral epicondyle I: digits 4, 5	**ext digitorum lateralis** O: lateral epicondyle I: digits 4, 5		**extenseur du V** O: lateral epicondyle I: digits 4, 5	**ext digitorum lateralis** O: w/ EDC lateral epicondyle I: digits 4, 5	**extenseur du V** O: lateral epicondyle I: digits 4, 5	**extenseur du V** O: w/ ECU lateral epicondyle I: digits 4, 5	**ext digitorum lateralis** O: lateral epicondyle I: digits 4, 5
EXT CARPI ULNARIS	**extenseur cubital du carpe** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5		**extenseur cubital du carpe** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + U I: base MC5	**extenseur cubital du carpe** O: lateral epicondyle I: base MC5	**extenseur cubital du carpe** O: lateral epicondyle + U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + U I: base MC5
SUPINATOR	**supinateur** O: lateral epicondyle I: cranial R	**supinator** O: cranial surface of lateral epicondyle I: cranial R		**supinateur** O: lateral epicondyle I: cranial R	**supinator** O: lateral epicondyle I: cranial R	**supinateur** O: lateral epicondyle I: cranial R	**supinateur** O: lateral epicondyle I: cranial R	**supinator** O: cranial surface of lateral epicondyle I: cranial R
ABD POLLICIS LONGUS	**long abducteur du pouce** O: lateral U + R I: MC1	**abd pollicis longus** O: cranio-lateral U + R I: base MC1		**long abducteur du pouce** O: lateral U + R I: MC1	**abd pollicis longus** O: lateral U + R I: MC1	**long abducteur du pouce** O: lateral U + R I: MC1	**long abducteur du pouce** O: lateral U + R I: MC2	**abd pollicis longus** O: cranio-lateral U I: distal MC2
EXT DIGITORUM PROFUNDUS	**extenseur profond des doigts** O: lateral olecranon I: digits 1, 2	**ext digitorum profundus** O: lateral olecranon I: lateral dig 1, medial dig 2 + 3		**extenseur profond des doigts** O: lateral olecranon I: digits 1, 2	**ext digitorum profundus** O: caudo-lateral olecranon I: digit 2	**extenseur profond des doigts** O: lateral olecranon I: digits 1, 2	**extenseur profond des doigts** O: lateral olecranon I: digit 2	**ext digitorum profundus** O: caudal surface lateral olecranon I: lateral dig 2
EXT BREVIS DIGITORUM		**ext brevis digitorum** -			**ext brevis digitorum** absent			**ext brevis digitorum** absent

	MACROSCELIDEA							
	Macroscelididae							
	Elephantulus **Jullien, 1967**	***Elephantulus*** **this work**	***Elephantulus*** **Haines, 1955**	***Macroscelides*** **Jullien, 1967**	***Petrodromus*** **this work**	***Petrodromus*** **Jullien, 1967**	***Rhynchocyon*** **Jullien, 1967**	***Rhynchocyon*** **this work**
PRONATOR TERES	**rond pronateur** O: medial epicondyle I: cranial R	**pronator teres** O: medial epicondyle I: cranial R		**rond pronateur** O: medial epicondyle I: cranial R	**pronator teres** O: medial epicondyle I: cranio-medial R	**rond pronateur** O: medial epicondyle I: cranial R	**rond pronateur** O: medial epicondyle I: cranial R	**pronator teres** O: medial epicondyle I: cranio-medial R
FLX CARPI RADIALIS	**fléchisseur radial du carpe** O: medial epicondyle I: base palmar MC2	**flx carpi radialis** O: medial epicondyle I: palmer base MC2	**flx carpi radialis** I: palmar base MC2+ 3	**fléchisseur radial du carpe** O: medial epicondyle I: base palmar MC2	**flx carpi radialis** O: medial epicondyle I: palmer base MC2	**fléchisseur radial du carpe** O: medial epicondyle I: base palmar MC2	**fléchisseur radial du carpe** O: medial epicondyle I: base palmar MC2	**flx carpi radialis** O: medial epicondyle I: palmer base MC2
PALMARIS LONGUS	**long palmaire** O: medial epicondyle I: MC2 , 3, 4, 5	**palmaris longus** O: medial epicondyle + FDS I: flexor retinaculum	**palmaris longus** I: flexor retinaculum	**long palmaire** O: medial epicondyle I: MC2 + 5	**palmaris longus** O: FCUe + FDPe I: palmar aponeurosis	**long palmaire** O: medial epicondyle I: MC2 + 5	**long palmaire** ? ?	**palmaris longus** O: humeral belly FCU + FDS I: palmar aponeurosis
FLX DIGITORUM SUPERFICIALIS	**fléchisseur superficiel des doigts** O: medial epicondyle I: digits 2, 3, 4 = p	**flx digitorum superficialis** O: caudal surface medial epicondyle w/ FDPd I: lateral dig 2, 3, 4		**fléchisseur superficiel des doigts** O: medial epicondyle I: digits 2, 3, 4 = p	**flx digitorum superficialis** O: caudal surface medial epicondyle w/ FDPe I: flexor sheath dig 2, 3, 4	**fléchisseur superficiel des doigts** O: medial epicondyle I: digits 2, 3, 4 = p	**fléchisseur superficiel des doigts** O: medial epicondyle I: digits 2, 3, 4 = p	**flx digitorum superficialis** O: caudal surface medial epicondyle I: digits 2, 3, 4 = p
INTERFLEXORII		absent			-			**present**

	MACROSCELIDEA							
	Macroscelididae							
	Elephantulus **Jullien, 1967**	***Elephantulus*** **this work**	***Elephantulus*** **Haines, 1955**	***Macroscelides*** **Jullien, 1967**	***Petrodromus*** **this work**	***Petrodromus*** **Jullien, 1967**	***Rhynchocyon*** **Jullien, 1967**	***Rhynchocyon*** **this work**
FLX DIGITORUM PROFUNDUS,	**fléchisseur profond des doigts**	**flx digitorum profundus**		**fléchisseur profond des doigts**	**flx digitorum profundus**	**fléchisseur profond des doigts**	**fléchisseur profond des doigts**	**flx digitorum profundus**
epicondylar								
epicondylar (FDPe)		O: medial epicondyle I: medial edge conjoined F tendon			O: medial epicondyle I: conjoined F tendon			O: caudal surface medial epicondyle I: conjoined F tendon
epicondylar (FDPd)		O: w/ FDS from caudal surface medial epicondyle I: FDPu			O: w/ FDS from caudal surface medial epicondyle I: medial edge conjoined F tendon			O: caudal surface medial epicondyle I: medial edge conjoined F tendon
ulnar		O: caudo-medial olecranon + U I: conjoined F			O: caudo-medial U I: conjoined F tendon			O: medial olecranon + U I: conjoined F tendon
radial								
	*I: dig 1, 2, 3, 4, 5	*I: dig 1, 2, 3, 4, 5		*I: dig 1, 2, 3, 4, 5	*I: dig 1, 2, 3, 4, 5	*I: dig 1, 2, 3, 4, 5	*I: dig 2, 3, 4	*I: dig 2, 3, 4
LUMBRICALES	**lombricaux** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP tendon I: medial dig 2, 3, 4, 5		**lombricaux** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP tendon I: medial dig 2, 3, 4, 5	**lombricaux** O: FDP I: digits 2, 3, 4, 5	**lombricaux** O: FDP I: digits 3, 4	**lumbricales** O: FDP tendon I: medial dig 3, 4
FLX CARPI ULNARIS,	**fléchisseur cubital du carpe**	**flx carpi ulnaris**		**fléchisseur cubital du carpe**	**flx carpi ulnaris**	**fléchisseur cubital du carpe**	**fléchisseur cubital du carpe**	**flx carpi ulnaris**
epitrochlear belly	O: medial epicondyle	O: medial epicondyle		O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle
ulnar belly	O: medial olecranon I: pisiform	O: medial olecranon I: pisiform		O: medial olecranon I: pisiform	O: medial olecranon I: pisiform	O: medial olecranon I: pisiform	O: medial olecranon I: pisiform	O: medial U + FDPu I: pisiform

	MACROSCELIDEA							
	Macroscelididae							
	Elephantulus **Jullien, 1967**	***Elephantulus*** **this work**	***Elephantulus*** **Haines, 1955**	***Macroscelides*** **Jullien, 1967**	***Petrodromus*** **this work**	***Petrodromus*** **Jullien, 1967**	***Rhynchocyon*** **Jullien, 1967**	***Rhynchocyon*** **this work**
EPITROCHLEO-ANCONEUS	**épitrochléo-olécrânien** O: medial epicondyle I: medial olecranon	**epitrochleo-anconeus** O: caudal medial epicondyle I: FCUu		**épitrochléo-olécrânien** O: medial epicondyle I: medial olecranon	**epitrochleo-anconeus** O: caudal medial epicondyle I: FCUu	**épitrochléo-olécrânien** O: medial epicondyle I: medial olecranon	**épitrochléo-olécrânien** O: medial epicondyle I: medial olecranon	**epitrochleo-anconeus** O: caudal H below entepicondylar forearm I: medial olecranon
PRONATOR QUADRATUS	**carré pronateur**	**pronator quadratus** O: proximal 1/3 R+U		**carré pronateur** O: U + R	**pronator quadratus** O: proximal 1/3 R+U	**carré pronateur** O: U + R	**carré pronateur** O: U + R	**pronator quadratus** O: proximal 1/3 R+U
PALMARIS BREVIS	**court palmaire** absent	**palmaris brevis** absent	**palmaris brevis** "beneath the very large hypothenar pad"	**court palmaire** absent	**palmaris brevis** absent	**court palmaire** absent	**court palmaire** absent	**palmaris brevis** absent
FLX DIGITORUM BREVIS MANUS	**court fléchisseur des doigts de la main** ? I: digit 5p	**flexor digitorum breves manus** ? I: digit 5	**flx brevis digitorum manus** ? I: digit 5	**court fléchisseur des doigts de la main** ? I: digit 5p	**flexor digitorum breves manus** O: fascia over pisiform I: MCPj digit 5	**court fléchisseur des doigts de la main** ? I: digit 5p	**court fléchisseur des doigts de la main** absent	**flexor digitorum breves manus** absent
ABD DIGITI MINIMI	**abducteur du V** O: pisiform I: digit 5	**abd digiti minimi** O: pisiform I: distal MC5		**abducteur du V** O: pisiform I: digit 5	**abd digiti minimi** O: pisiform I: distal MC5	**abducteur du V** O: pisiform I: digit 5	**abducteur du V** - -	**abd digiti minimi** O: pisiform I: distal MC5
ABD POLLICIS BREVIS	**abducteur du I**	**abd pollicis brevis** -	**abd pollicis** -	**abducteur du I**	**abd pollicis brevis** -	**abducteur du I**	**abducteur du I** -	**abd pollicis brevis** -

	MACROSCELIDEA							
	Macroscelididae							
	Elephantulus Jullien, 1967	*Elephantulus* this work	*Elephantulus* Haines, 1955	*Macroscelides* Jullien, 1967	*Petrodromus* this work	*Petrodromus* Jullien, 1967	*Rhynchocyon* Jullien, 1967	*Rhynchocyon* this work
CONTRAHENTES	**contracteurs des doigts** O : carpus I: digits 1, 2, 5	**contrahentes** O : carpus I: digits 1, 2, 5	**contrahentes** O : carpus I: digits 1, 2, 5	**contracteurs des doigts** O : carpus I: digits 1, 2, 5	**contrahentes** O: carpus I: digits 1, 2, 5	**contracteurs des doigts** O : carpus I: digits 1, 2, 5	**contracteurs des doigts** O : carpus I: digits 2,4, 5	**contrahentes** O: carpus base MC3 I: digits 2, 4, 5
FLEXOR BREVES PROFUNDUS	**muscles interosseux** 10 O: fibrous sheet	**flexor breves profundus** 10 O: fibrous sheet w/ 3 cartilage plates	**flexor breves profundus** 10 O: fibrous sheet w/ 4 cartilage plates	**muscles interosseux** 10 O: fibrous sheet	**flexor breves profundus** 10 O: fibrous sheet	**muscles interosseux** 9 O: fibrous sheet	**muscles interosseux** 7 O: fibrous sheet	**flexor breves profundus** 8 O: fibrous sheet
INTERMETACARPALES		**intermetacarpales** -			**intermetacarpales** -			**intermetacarpales** -
? Unknown homology								
RADIAL SESAMOID "PRE-POLLUX"		absent			absent	absent	absent	
ULNAR SESAMOID		absent	small - base MC5		absent	absent	absent	
CARPAL VIBRISSAE								

	SIRENIA			HYRACOIDEA			
	Dugongidae	Trichechidae		Procaviidae			
	Dugong **Domning, 1977**	***Trichechus*** **Murie, 1872a + 1885**	***Trichechus*** **Domning, 1978**	***Procavia*** **Murie + Mivart, 1865**	***Heterohyrax*** **this work**	***Procavia*** **this work**	***Procavia*** **Windle & Parsons, 1901**
PANNICULUS CARNOSUS	**cutaneous trunci** O: back + sides I: merge w/ latissimus	**panniculus carnosus** O: entire surface "enormously developed" I: slip to H	**cutaneous trunci** O: back + sides I: superficial fascia at elbow	**panniculus carnosus** O: back + sides, "closely connected" w/ LD I: fascia over scapula, w/ PP, w/ TMA/LD	**panniculus carnosus** O: back + sides I: fascia over shoulder	**panniculus carnosus** O: back + sides I: fascia over shoulder	
STERNO-FACIALIS							
STERNOMASTOIDEUS	**sphincter colli profundus ?pars auris** O: zygomatic process squamosal I: ventral raphe + manubrium w/ CM		**sphincter colli profundus ?pars auris** O: zygomatic arch I: manubrium, superficial to PS	**sterno-mastoid** O: ramus mandible I: ventral raphe + manubrium	**sternomastoideus** O: ramus mandible I: ventral raphe + manubrium	**sternomastoideus** O: ramus mandible I: ventral raphe + manubrium	**sterno-masseteric** O: angle of mandible I: manubrium + ventral raphe
CLEIDOMASTOIDEUS	**sternomastoideus** O: posttympanic process squamosal I: manubrium w/ SM	**sterno-mastoid** O: paramastoid I: manubrium, superficial to PS	**sternomastoideus** O: sigmoid ridge squamosal I: manubrium w/ SM		**cleidomastoideus** O: paroccipital I: manubrium	**cleidomastoideus** O: paroccipital I: manubrium	**sterno-mastoid** O: paramastoid process I: manubrium
CLAVOTRAPEZIUS	**cephalohumeralis** O: between zygomatic + sigmoid ridge squamosal I: at clavicular intersection w/ OT	**cephalo-humeral** O: occipital crest I: around H head to neck	**cephalohumeralis** O: sides of squamosal I: at clavicular intersection w/ OT	**cephalo-humeral / cleido-mastoid** O: occipital crest I: clavicular intersection	**clavotrapezius** O: occipital crest I: clavicular intersection * slip to pinna	**clavotrapezius** O: occipital crest I: clavicular intersection	**cleido-mastoid** O: occipital crest
CEPHALOHUMERALIS	**(CT + OT / CD)**	**(CT + OT / CD)**	**(CT + OT / CD)**		**(CT + OT / CD)**	**(CT + OT / CD)**	

	SIRENIA			HYRACOIDEA			
	Dugongidae	**Trichechidae**		**Procaviidae**			
	Dugong **Domning, 1977**	***Trichechus*** **Murie, 1872a + 1885**	***Trichechus*** **Domning, 1978**	***Procavia*** **Murie + Mivart, 1865**	***Heterohyrax*** **this work**	***Procavia*** **this work**	***Procavia*** **Windle & Parsons, 1901**
ACROMIOTRAPEZIUS	**trapezius** O: dorsal midline to lateral occipital crest I: spine scapula	**trapezius** O: occiput, C verts I: spine scapula + acromion	**trapezius** O: occiput, thoracic aponeurosis I: spine scapula	**trapezius, anterior part** O: occiput, ligamentum nuchae, prox T verts I: acromion	**acromiotrapezius** O: ligamentum nuchae + T1-3 verts I: fascia over supraspinatus	**acromiotrapezius** O: ligamentum nuchae + T1-3 verts I: fascia over supraspinatus	
INTERMEDIATE TRAPEZIUS / DORSO-CUTANEUS	**?**				- - -	- - -	
SPINOTRAPEZIUS	**trapezius** O: dorsal midline I: w/ AT, sep by "tendinous embayment"			**trapezius, posterior part** O: w/ AT I: base scap spine	**spinotrapezius** O: 12 T verts I: dist 1/3 scap spine	**spinotrapezius** O: T verts I: dist 1/3 scap spine	
RHOMBOIDEUS CAPITIS				**r. capitis / occipito-scapular** O: occiput, ligamentum nuchae, T verts I: near base scapula spine	**r. capitis** O: occiput + ligamentum nuchae I: cartilage near cranial angle	**r. capitis** O: occiput I: near cranial angle	**r. capitis**
RHOMBOIDEUS CERVICIS				**r. minor** O: T6 I: cartilaginous part scapula	**r. cervicis** O: ligamentum nuchae I: cartilage along vertebral border	**r. cervicis** O: ligamentum nuchae + prox T vert I: cartilage along vertebral border	**r. colli et thoracis** O: ligamentum nuchae, T1-10 I: deep surface cartilaginous portion scapula

	SIRENIA			HYRACOIDEA			
	Dugongidae	**Trichechidae**		**Procaviidae**			
	Dugong **Domning, 1977**	***Trichechus*** **Murie, 1872a + 1885**	***Trichechus*** **Domning, 1978**	***Procavia*** **Murie + Mivart, 1865**	***Heterohyrax*** **this work**	***Procavia*** **this work**	***Procavia*** **Windle & Parsons, 1901**
RHOMBOIDEUS THORACIS	**rhomboideus** O: dorsal midline T region I: vertebral border scapula + cartilage	**rhomboideus** I: vertebral border scapula	**rhomboideus** O: dorsal midline I: vertebral border scapula + cartilage	**r. major** O: T6-10 I: caudal angle scapula	**r. thoracis** O: T verts I: cartilage near caudal angle scapula	**r. thoracis** O: T6 I: cartilage near caudal angle scapula	
OMOTRANSVERSARIUS "metacromion"	**trapezius: anteriorly a separate slip 1.5cm wide** O: sigmoid ridge squamosal I: fascia on medial side DP crest of H			**levator claviculae** O: atlas I: fascia over teres minor	**omotransversarius, dorsal belly** O: C3 I: fascia over infraspinatus	**omotransversarius, dorsal belly** O: C3 I: fascia over infraspinatus	**omo-trachelien** O: atlas I: fascia over scapula
OMOTRANSVERSARIUS	**brachiocephalicus** O: paroccipital process of exoccipital I: at clavivular intersection w/ CT	**levator claviculae (?)** O: paramastoid I: fuses w/ CT	**brachiocephalicus** O: sigmoid ridge + exoccipital I: at clavivular intersection w/ CT	**sterno-cleido-mastoid, third part** O: paramastoid I: clavicular intersection = CH	**omotransversarius, ventral belly** O: paroccipital + atlas I: w/ CT at clavicular intersection = CH	**omotransversarius, ventral belly** O: atlas I: w/ CT at clavicular intersection = CH	
OMOHYOIDEUS				**omo-hyoid** "did not find"	**omohyoideus** absent	**omohyoideus** absent	**omo-hyoid** absent
SERRATUS VENTRALIS CERVICIS	**serratus magnus**	**serratus magnus** O: C2-7 I: vertebral border + caudal angle scapula	**serratus magnus** O: C3-5/6, C2-5, I: vertebral border + caudal angle scapula	**levator anguli scapulae** O: C3-7, ribs 1-5 I: w/ SVT on vertebral border scapula	**serratus ventralis cervicis** O: C3-C7, ribs 1-5 I: w/ SVT on vertebral border + caudal angle scapula	**serratus ventralis cervicis** O: C3-C7, ribs 1-5 I: w/ SVT on vertebral border + caudal angle scapula	**levator anguli scapulae** O: C5-7

	SIRENIA			HYRACOIDEA			
	Dugongidae	Trichechidae		Procaviidae			
	Dugong **Domning, 1977**	***Trichechus*** **Murie, 1872a + 1885**	***Trichechus*** **Domning, 1978**	***Procavia*** **Murie + Mivart, 1865**	***Heterohyrax*** **this work**	***Procavia*** **this work**	***Procavia*** **Windle & Parsons, 1901**
SERRATUS VENTRALIS THORACIS	**serratus magnus** O: rib 1, ribs 2-9 I: vertebral border + caudal angle scapula	**serratus magnus** O: ribs 1-6 I: vertebral border + caudal angle scapula	**serratus magnus** O: ribs 1-6 I: vertebral border + caudal angle scapula	**serratus magnus** O: 10 digitations from ribs 5-15 I: w/ SVC on vertebral border scapula	**serratus ventralis thoracis** O: 8 digitations from ribs 4-11 I: w/ SVC on vertebral border + caudal angle scapula	**serratus ventralis thoracis** O: 7 digitations from ribs 5-11 I: w/ SVC on vertebral border + caudal angle scapula	**serratus magnus** O: ribs 1-14 I: deep surface scapula
CLAVODELTOIDEUS	**brachiocephalicus + cephalohumeralis** O: clavicular intersection I: distal DP crest		**brachiocephalicus + cephalohumeralis** O: clavicular intersection I: distal DP crest	**cephalo-humeral / cleido-mastoid** O: clavicular intersection I: medial U w/ BB	**clavodeltoideus** O: clavicular intersection I: medial U	**clavodeltoideus** O: clavicular intersection I: medial U	**cephalo-humeralis** O: clavicular intersection I: w/ BB
ACROMIODELTOIDEUS		**deltoid** O: loose acromial cartilage I: middle of H		**deltoid** O: GT I: lateral H	**acromiodeltoideus** O: fascia over supraspinatus I: w/ SD on lateral DP crest	**acromiodeltoideus** ? fused w/ SD	**deltoid, acromial part** absent
SPINODELTOIDEUS	**deltoideus** O: acromion + spine scapula I: lateral DP crest	**deltoid** O: spine of scapula I: middle of H	**deltoideus** O: acromion + spine scapula I: lateral DP crest	**deltoid** O: fascia over infraspinatus I: lateral H	**spinodeltoideus** O: fascia over infraspinatus I: w/ AD on lateral DP crest	**spinodeltoideus** O: fascia over infraspinatus I: lateral DP crest	**deltoid, spinous portion** O: spine scapula + fascia IN
TERES MINOR	**teres minor** absent	**teres minor** absent	**teres minor** O: tendon exposed on caudal edge IN I: inserts w/ IN on LT	**teres minor** O: caudal border scapula I: distal GT	**teres minor** O: caudal border scapula I: distal GT	**teres minor** O: caudal border scapula I: distal GT	**teres minor** O: caudal border scapula I: GT
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT

	SIRENIA			HYRACOIDEA			
	Dugongidae	**Trichechidae**		**Procaviidae**			
	Dugong **Domning, 1977**	***Trichechus*** **Murie, 1872a + 1885**	***Trichechus*** **Domning, 1978**	***Procavia*** **Murie + Mivart, 1865**	***Heterohyrax*** **this work**	***Procavia*** **this work**	***Procavia*** **Windle & Parsons, 1901**
TERES MAJOR	**teres major** O: caudal border scapula I: medial H	**teres major** O: caudal border scapula I: w/ LD middle H	**teres major** O: caudal border scapula I: w/ LD into pit on medial H	**teres major** O: caudal border scapula I: w/ LD on medial H	**teres major** O: caudal border scapula I: w/ LD on medial H	**teres major** O: caudal angle scapula I: w/ LD on medial H	**teres major**
LATISSIMUS DORSI "superficial" "deep"	**latissimus dorsi** O: w/ PC I: w/ PP	**latissimus dorsi** O: ribs 4-8 I: w/ TMA on middle H	**latissimus dorsi** O: thoracic aponeurosis, ribs 4-6 I: w/ TMA on middle H 2 parts	**latissimus dorsi** O: T verts I: medial H w/ TMA * slips w/ PC to BB fascia	**latissimus dorsi** O: thoracolumbar fascia + T12-20 + L1 verts I: medial H w/ TMA * slip from medial edge to BB fascia	**latissimus dorsi** O: T12-20 verts I: medial H w/ TMA * slips w/ PC, BB fascia, PP	**latissimus dorsi** O: T10-20 slips crossing in front of vessels
DORSO-EPITROCHLEARIS		**teres major** "distinct fleshy slip which passes from LD to TMA at tendon of insertion"		**dorso-epitrochlear** O: over infraspinatus I: olecranon	**dorso-epitrochlearis** O: ? I: medial olecranon	**dorso-epitrochlearis** O: LD, PC near IN I: medial olecranon	**dorso-epitrochlearis** O: IN + LD
PECTORALIS SUPERFICIALIS "clavicular"							
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis major** O: sternum I: distal DP crest, slip w/PP + LD	**pectoralis major** O: sternum + abdomen I: deep pit on distal medial bicipital groove H, fascia over R	**pectoralis major** O: manubrium + sternum I: pit in distal third medial H	**pectoralis major** O: sternum I: lateral DP crest	**pectoralis superficialis, superficial layer** O: sternum I: DP crest	**pectoralis superficialis, superficial layer** O: sternum I: DP crest	**pectoralis, superficial** O: manubrium + sternum I: pectoral ridge + H, fascia of forearm near elbow

	SIRENIA			HYRACOIDEA			
	Dugongidae	Trichechidae		Procaviidae			
	Dugong Domning, 1977	***Trichechus*** Murie, 1872a + 1885	***Trichechus*** Domning, 1978	***Procavia*** Murie + Mivart, 1865	***Heterohyrax*** this work	***Procavia*** this work	***Procavia*** Windle & Parsons, 1901
PECTORALIS SUPERFICIALIS "deep"		"indistinct division into sternal and manubrial portions"			**pectoralis superficialis, deep layer** O: sternum I: DP crest	**pectoralis superficialis, deep layer** O: sternum I: DP crest	
PECTORALIS PROFUNDUS	**pectoralis minor** O: rectus abdominis + rib 4 I: medial DP crest	**pectoralis minor** O: sternum, ribs 2 + 3 I: head of H	**pectoralis minor** O: "sternocostalis" and rib 1, 2, 3 I: H near GT	**pectoralis minor** O: sternum I: GT	**pectoralis profundus** O: xiphisternum I: prox DP crest	**pectoralis profundus** O: xiphisternum, ribs 4-6 I: prox DP crest	**pectoralis minor** O: sternum I: GHj capsule w/ PA
PECTORALIS ABDOMINALIS					**pectoralis abdominalis** O: lateral abdomen I: w/ LD, D-E, to LT	**pectoralis abdominalis** O: lateral abdomen I: w/ LD, to LT GT	**pectoralis quartus** O: sternum + linea alba I: GT + PC
SUBCLAVIUS				**subclavius** "absent"	**subclavius** O: manubrium I: w/ S-S at the clavicular intersection	**subclavius** ? w/ S-S ? w/ S-S	
STERNOSCAPULARIS				**sterno-scapular** O: sternum I: scapula	**sternoscapularis** O: sternum I: fascia over supraspinatus	**sternoscapularis** O: sternum I: fascia over supraspinatus	**subclavius + sterno-scapularis** O: manubrium + ribs 1-3 I: fascia over supraspinatus
CORACOBRACHIALIS	**coracobrachialis** O: medial coracoid process I: proximal medial epicondyle	**biceps, long inner** O: coracoid process I: distal medial H	**coracobrachialis** O: medial coracoid process I: caudo-medial H	**coraco-brachialis** O: coracoid process I: medial H	**coracobrachialis** O: coracoid process I: cranio-medial H	**coracobrachialis** O: coracoid process I: cranio-medial H	**coraco-brachialis medius** I: middle H

	SIRENIA			HYRACOIDEA			
	Dugongidae	Trichechidae		Procaviidae			
	Dugong Domning, 1977	*Trichechus* Murie, 1872a + 1885	*Trichechus* Domning, 1978	*Procavia* Murie + Mivart, 1865	*Heterohyrax* this work	*Procavia* this work	*Procavia* Windle & Parsons, 1901
CORACOBRACHIALIS							
BICEPS BRACHII, short head							
BICEPS BRACHII, long head	**biceps brachii** O: rim of glenoid cavity I: medial R + U	**biceps, short outer** O: lateral CB I: R tuberosity	**biceps brachii** O: rim of glenoid cavity I: medial R	**biceps** O: scapula I: neck of U w/ CD	**biceps brachii** O: supraglenoid tubercle I: medial U	**biceps brachii** O: supraglenoid tubercle I: medial U	**biceps flexor longus cubiti** O: glenoid I: U
BRACHIALIS	**brachialis, first division** O: lateral H I: proximal R	**brachialis anticus** O: lateral H I: proximal R	**brachialis** O: lateral H I: proximal R	**brachialis anticus** O: caudal neck H I: medial U	**brachialis** O: behind H head I: medial U	**brachialis** O: behind H head I: medial U	**brachialis anticus** O: caudal neck H I: U
? CUBITALIS ?	**brachialis, second division** I: distal R		**"check ligament"** O: rugosity on proximal H I: medial R	**supinator longus** O: lateral H "diminuitive" I: R neck	**cubitalis** O: middle cranial H I: medial U	**cubitalis** O: middle cranial H I: medial U	**brachialis - "distinct short head"** O: distal H
SUPRASPINATUS	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: front H head	**supraspinatus** O: supraspinous fossa I: GT	**supra-spinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT + LT

	SIRENIA			HYRACOIDEA			
	Dugongidae	Trichechidae		Procaviidae			
	Dugong **Domning, 1977**	***Trichechus*** **Murie, 1872a + 1885**	***Trichechus*** **Domning, 1978**	***Procavia*** **Murie + Mivart, 1865**	***Heterohyrax*** **this work**	***Procavia*** **this work**	***Procavia*** **Windle & Parsons, 1901**
INFRASPINATUS	**infraspinatus** I: infraspinous fossa I: lateral GT	**infraspinatus** I: infraspinous fossa I: GT	**infraspinatus** I: infraspinous fossa I: lateral GT	**infra-spinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT
TRICEPS BRACHII CAPUT LATERALE	**triceps, lateral head** O: neck H I: lateral olecranon	**triceps, middle head** O: neck H I: olecranon	**triceps, lateral head** O: neck H I: w/ TLO on lateral olecranon	**triceps, second/outer** O: neck H below GT I: lateral olecranon + lateral epicondyle	**triceps brachii caput laterale** O: lateral H I: lateral olecranon	**triceps brachii caput laterale** O: lateral H I: lateral olecranon	
TRICEPS BRACHII CAPUT MEDIALE	**triceps, medial head** O: caudal H I: lateral, cranial, medial olecranon	**triceps, short head** O: caudal H I: olecranon	**triceps, medial head** O: caudal H I: lateral, cranial, medial olecranon	**triceps, third/inner** O: medial neck H I: medial olecranon	**triceps brachii caput mediale** O: caudo-medial H I: medial olecranon	**triceps brachii caput mediale** O: caudo-medial H I: medial olecranon	
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps, long head** O: caudal surface neck of scapula I: tip + medial olecranon	**triceps, long scapular** O: GHj capsule I: olecranon	**triceps, long head** O: caudal surface neck of scapula I: w/ TLA on tip olecranon	**triceps, first/scapular** O: neck of scapula I: olecranon	**triceps brachii caput longum deep** O: caudal border scapula I: w/ TLOs on tip olecranon	**triceps brachii caput longum deep** O: caudal border scapula I: w/ TLOs on tip olecranon	
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)					**triceps brachii caput longum superficial** O: caudal border scapula I: w/ TLOd on tip olecranon	**triceps brachii caput longum superficial** O: caudal border scapula I: w/ TLOd on tip olecranon	
TRICEPS BRACHII ACCESSORY					- -	- -	

	SIRENIA			HYRACOIDEA			
	Dugongidae	Trichechidae		Procaviidae			
	Dugong	***Trichechus***	***Trichechus***	***Procavia***	***Heterohyrax***	***Procavia***	***Procavia***
	Domning, 1977	**Murie, 1872a + 1885**	**Domning, 1978**	**Murie + Mivart, 1865**	**this work**	**this work**	**Windle & Parsons, 1901**
ANCONEUS		**anconeus** absent	**anconeus** absent	**triceps, fourth** O: w/ TME caudal H I: medial olecranon + medial epicondyle	**anconeus** O: caudal H I: cranial olecranon	**anconeus** O: caudal H I: cranial olecranon	
BRACHIORADIALIS	**brachioradialis** O: lateral epicondyle I: carpals + MC1	**supinator longus** O: above lateral condyle I: trapezium	**brachioradialis** O: ectepicondyle of H I: carpals		**brachioradialis** absent	**brachioradialis** absent	**supinator longus** absent
EXT CARPI RADIALIS, longus (MC2)	**extensor carpi radialis** O: lateral epicondyle I: MC2	**extensores carpi radiales longior and brevior** O: lateral condyle I: MC 2 + 3	**extensor carpi radialis** O: ectepicondyle of H I: MC 2 + 3	**ext carpi longior** O: w/ ECRb lateral epicondyle I: MC2	**ext carpi radialis longus** O: lateral supracondylar crest I: base MC2	**ext carpi radialis longus** O: lateral supracondylar crest I: base MC2	**ext carpi radiales longior & brevior** I: MC2
EXT CARPI RADIALIS, brevis (MC3)				**ext carpi brevior** O: w/ ECRl lateral epicondyle I: MC3	**ext carpi radialis brevis** O: lateral supracondylar crest I: base MC3	**ext carpi radialis brevis** O: lateral supracondylar crest I: base MC3	**ext carpi radiales longior & brevior** I: MC3
EXT DIGITORUM COMMUNIS	**extensor digitorum communis** O: lateral epicondyle I: digits 2, 3, 4	**extensor communis digitorum** O: lateral condyle + U I: digits 2, 3, 4, 5	**extensor digitorum communis** O: ectepicondyle of H I: digits (1), 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral supracondylar crest + epicondyle I: lateral dig 2, center dig 3, medial dig 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5

	SIRENIA			HYRACOIDEA			
	Dugongidae	**Trichechidae**		**Procaviidae**			
	Dugong **Domning, 1977**	***Trichechus*** **Murie, 1872a + 1885**	***Trichechus*** **Domning, 1978**	***Procavia*** **Murie + Mivart, 1865**	***Heterohyrax*** **this work**	***Procavia*** **this work**	***Procavia*** **Windle & Parsons, 1901**
EXT DIGITORUM LATERALIS	**extensor digiti quinti** O: lateral epicondyle I: MC5	**extensor minimi digiti** O: R-U ligament I: digit 5 + MC5	**extensor digiti quinti** O: R + U, GHj capsule I: MC5	**ext minimi digiti** O: "as usual" I: MC4, digit 5	**ext digitorum lateralis** O: lateral epicondyle I: lateral dig 4, 5	**ext digitorum lateralis** O: lateral epicondyle I: lateral dig 4, 5	**ext minimi digiti** O: lateral epicondyle I: digits 4+5
EXT CARPI ULNARIS	**extensor carpi ulnaris** O: lateral epicondyle + olecranon I: pisiform + MC5	**extensor carpi ulnaris** O: caudal surface lateral condyle I: MC5 + carpals	**extensor carpi ulnaris** O: ectepicondyle of H + olecranon I: cuneiform-pisiform + MC5	**ext carpi ulnaris** O: coronoid process U + lateral epicondyle I: MC5 + pisiform	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: MC5
SUPINATOR		**supinator brevis** I: w/ B			**supinator** absent	**supinator** absent	**supinator brevis** I: w/ APL
ABD POLLICIS LONGUS	**? abductor pollicis longus** O: R + U I: MC1	**extensor secondi internodii pollicis** O: interosseus interval I: joins EDL		**ext ossis metacarpi pollicis** O: "rather extensive" I: trapezium + pollex rudiments	**abd pollicis longus** O: lateral U + R I: tiny MC1	**abd pollicis longus** O: lateral U + R I: trapezium + tiny MC1	**ext ossis metacarpi pollicis** I: MC1
EXT DIGITORUM PROFUNDUS	**extensor pollicis brevis et longus** O: lateral U + olecranon I: MC1	**extensor primi internodii pollicis** O: lateral U I: MC1	**extensor pollicis brevis et longus** O: lateral U I: MC1		**ext digitorum profundus** absent	**ext digitorum profundus** absent	
EXT BREVIS DIGITORUM					**ext brevis digitorum** absent	**ext brevis digitorum** absent	

	SIRENIA			HYRACOIDEA			
	Dugongidae	**Trichechidae**		**Procaviidae**			
	Dugong **Domning, 1977**	***Trichechus*** **Murie, 1872a + 1885**	***Trichechus*** **Domning, 1978**	***Procavia*** **Murie + Mivart, 1865**	***Heterohyrax*** **this work**	***Procavia*** **this work**	***Procavia*** **Windle & Parsons, 1901**
PRONATOR TERES	**pronator teres** O: medial epicondyle I: medial R	**pronator radii teres** O: medial condyle I: middle of R	**pronator teres** "did not find"	**pronator teres** O: medial epicondyle I: middle H (=R)	**pronator teres** O: medial epicondyle I: cranial R	**pronator teres** O: medial epicondyle I: cranial R	**pronator teres** rudimentary
FLX CARPI RADIALIS	**flexor carpi radialis** O: medial epicondyle I: MC1 + 2	**flexor carpi radialis** O: medial condyle I: MC1 + 2	**flexor carpi radialis** O: entepicondyle of H I: MC1 + 2	**flx carpi radialis** O: medial epicondyle I: trapezium	**flx carpi radialis** O: medial epicondyle I: trapezium	**flx carpi radialis** O: medial epicondyle I: palmer base MC2	**flx carpi radialis** O: medial epicondyle
PALMARIS LONGUS	**palmaris longus** O: w/ FCU I: w/ FCU	**palmaris longus** O: medial condyle	**palmaris longus** O: medial epicondyle w/ FCR I: surface of palmar muscles + digits 2 + 3	**palmaris longus** O: medial epicondyle I: palmar fascia	**palmaris longus** O: medial epicondyle I: fibrocartilaginous plate on palm	**palmaris longus** O: medial epicondyle I: fibrocartilaginous plate on palm	**palmaris longus** present ulnar nerve
FLX DIGITORUM SUPERFICIALIS	**flexor digitorum superficialis** O: distal medial epicondyle I: digits 2, 3	**flexor sublimis** O: w/ FDP medial condyle I: digits 2, 3, 4		**flx sublimis digitorum** O: w/ FDP I: digits 2, 3f, 4f	**flx digitorum superficialis** O: w/ FDPe from distal medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum superficialis** O: w/ FDPd from distal medial epicondyle I: digits 3f, 4f, 5	**flx sublimis digitorum** I: digits 2, 3, 4
INTERFLEXORII					**present**	**-**	

	SIRENIA			HYRACOIDEA			
	Dugongidae	**Trichechidae**		**Procaviidae**			
	Dugong **Domning, 1977**	***Trichechus*** **Murie, 1872a + 1885**	***Trichechus*** **Domning, 1978**	***Procavia*** **Murie + Mivart, 1865**	***Heterohyrax*** **this work**	***Procavia*** **this work**	***Procavia*** **Windle & Parsons, 1901**
FLX DIGITORUM PROFUNDUS,	**flexor digitorum profundus**	**flexor profundus + flexor longus pollicis**	**flexor digitorum superficialis et profundus**	**flx profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx profundus digitorum**
epicondylar							
epicondylar (FDPe)		O: w/ FDS medial condyle	O: medial epicondyle		O: w/ FDS from distal medial epicondyle I: conjoined F	O: medial epicondyle I: medial side conjoined F	O: medial epicondyle
epicondylar (FDPd)					O: caudal medial epicondyle I: medial edge conjoined F	O: w/ FDS from distal medial epicondyle I: conjoined F	
ulnar	O: medial olecranon + U				O: caudal edge U I: conjoined F	O: medial olecranon + caudal edge U I: conjoined F	O: medial olecranon
radial							O: R
	I: digits 3, 4	*I: digits 2, 3, 4	I: digits 2, 3, 4, 5	*I: digits 2, 3, 4, 5	*I: digits 2, 3, 4, 5	*I: digits 2, 3, 4, 5	*I: digits 2, 3, 4, 5
LUMBRICALES		**lumbrical** I: digit 4		**lumbricales** O: FDP I: lateral digit 2, medial digit 4	**lumbricales** O: FDP I: medial digits 3, 4	**lumbricales** O: FDP I: medial digits 3, 4	**lumbricales** I: digits 3, 4
FLX CARPI ULNARIS,	**flexor carpi ulnaris**	**flexor carpi ulnaris**	**flexor carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**
epitrochlear belly	O: medial epicondyle	O: medial condyle	O: entepicondyle of H	O: "usual origin"	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle
ulnar belly					O: medial olecranon	O: medial olecranon	O: medial olecranon
	I: w/ FDS, MC5	I: MC5	I: MC5	I: pisiform	I: pisiform	I: pisiform	

	SIRENIA			HYRACOIDEA			
	Dugongidae	Trichechidae		Procaviidae			
	Dugong **Domning, 1977**	***Trichechus*** **Murie, 1872a + 1885**	***Trichechus*** **Domning, 1978**	***Procavia*** **Murie + Mivart, 1865**	***Heterohyrax*** **this work**	***Procavia*** **this work**	***Procavia*** **Windle & Parsons, 1901**
EPITROCHLEO-ANCONEUS					**epitrochleo-anconeus** absent	**epitrochleo-anconeus** O: medial epicondyle I: medial olecranon	
PRONATOR QUADRATUS					**pronator quadratus** O: vestigial I: distal third R + U	**pronator quadratus** O: vestigial I: distal third R + U	**pronator quadratus** absent
PALMARIS BREVIS					**palmaris brevis** absent	**palmaris brevis** absent	
FLX DIGITORUM BREVIS MANUS	**? flexor digiti quinti brevis** O: palmar aponeurosis + ulnar carpal I: MC5		**? flexor digiti quinti brevis** O: fascia of ulnar carpal + retinaculum I: digit 5	**flx brevis manus** O: fibrocartilaginous disk I: digits 2, 4f, 5	**flexor digitorum breves manus** O: fibrocartilaginous plate of palm I: digits 2, 4, 5	**flexor digitorum breves manus** O: fibrocartilaginous plate of palm I: digits (1), 2, 4, 5	**flx brevis digitorum manus** median nerve I: digits 2, 3f, 4f
ABD DIGITI MINIMI	**? abductor digiti quinti** O: antebrachial fascia I: MC5	**abductor minimi digiti** O: PL I: MC5	**? abductor digiti quinti** O: antebrachial fascia I: MC5	**abd minimi digiti** O: pisiform I: digit 5	**abd digiti minimi** O: pisiform I: MC5	**abd digiti minimi** O: pisiform I: digit 5	**abd minimi digiti** O: pisiform
ABD POLLICIS BREVIS					**abd pollicis brevis** -	**abd pollicis brevis** -	

	SIRENIA			HYRACOIDEA			
	Dugongidae	**Trichechidae**		**Procaviidae**			
	Dugong **Domning, 1977**	***Trichechus*** **Murie, 1872a + 1885**	***Trichechus*** **Domning, 1978**	***Procavia*** **Murie + Mivart, 1865**	***Heterohyrax*** **this work**	***Procavia*** **this work**	***Procavia*** **Windle & Parsons, 1901**
CONTRAHENTES	**lumbricales** O: carpus I: digits 3, 4, 5	**superficial interossei / flexores breves** O: carpus I: digits 2, 4, 5	**lumbricales** O: carpus I: digits 3, 4, 5	**interossei** O: carpal fascia I: medial digits 4x2, 5	**contrahentes** O: cartilaginous plate over carpals I: digits 2L, 4M, 5M	**contrahentes** O: cartilaginous plate over carpals I: digits 2L, 4M, 5M	
FLEXOR BREVES PROFUNDUS	**interossei** 7	**flexores breves + dorsal interossei** 10	**interossei, ? flexor pollicis brevis** 9	**interossei** 9	**flexor breves profundus** 9 O: fibrous sheet w/ 2 cartilage plates	**flexor breves profundus** 9 O: fibrous sheet w/ 2 cartilage plates	**interossei or flexores breves + thenar muscles** 9
INTERMETACARPALES					**abd indicis**	**abd indicis**	
? Unknown homology							
RADIAL SESAMOID "PRE-POLLUX"					? Present, or vestigial MC1	? Present, or vestigial MC1	
ULNAR SESAMOID					absent	absent	
CARPAL VIBRISSAE							

	PROBOSCIDEA				
	Elephantidae				
	Elephas **Anderson, 1883**	***Elephas*** **Miall + Greenwood, 1878a+b**	***Elephas*** **Nielsen, 1965**	***Elephas*** **Shindo + Mori, 1956a+b**	***Elephas*** **Windle + Parsons, 1901**
PANNICULUS CARNOSUS		**panniculus** O: back + sides I: scapula		**cutaneus trunci** O: back + sides I: scapula over infraspinatus + slip to atlas; pectoral fascia	
STERNO-FACIALIS				^ origins of these muscles were switched and both labeled	
STERNOMASTOIDEUS	**sterno-maxillaris** O: mandible I: ventral raphe, manubrium, rib 1	**sterno-maxillaris** O: mandible I: rib 1		**sternomandibularis ^** O: mandible I: rib 1	O: mandible
CLEIDOMASTOIDEUS	**sterno-mastoid** O: zygoma I: sternum	**sterno-mastoideus** O: zygomatic arch I: rib 1		**sterno-mastoideus ^** O: zygomatic arch I: sternum	
CLAVOTRAPEZIUS	**masto-humeral, second part** O: basilar process occipital I: clavicular intersection	**masto-humeralis** O: basilar process occipital I: clavicular intersection		**cephalobrachialis/ cephalo-humeralis/ mastoido-brachialis (in figures only)** O: occipital crest I: H w/ deloideus = clavicular intersection	
CEPHALOHUMERALIS	**(CT + OT / CD)**	**(CT + OT / CD)**		**(CT + OT / CD)**	

	PROBOSCIDEA				
	Elephantidae				
	Elephas Anderson, 1883	*Elephas* Miall + Greenwood, 1878a+b	*Elephas* Nielsen, 1965	*Elephas* Shindo + Mori, 1956a+b	*Elephas* Windle + Parsons, 1901
ACROMIOTRAPEZIUS	**trapezius upper** O: occiput, ligamentum nuchae + T3-T14 I: spine scapula + acromion	**trapezius** O: ligamentum nuchae + T3-T14 I: spine scapula + acromion		**trapezius, cranial part** O: ligamentum nuchae + T3-T14 I: spine scapula + acromion	
INTERMEDIATE TRAPEZIUS / DORSO-CUTANEUS	- - -				
SPINOTRAPEZIUS	**trapezius posterior** O: w/ AT I: posterior spine scapula			**trapezius, caudal part**	
RHOMBOIDEUS CAPITIS				**occipitoscapularis** O: occiput I: cranial angle scapula	**r. capitis** absent
RHOMBOIDEUS CERVICIS		**r. minor** O: C7 I: caudal angle scapula			

	PROBOSCIDEA				
	Elephantidae				
	Elephas **Anderson, 1883**	***Elephas*** **Miall + Greenwood, 1878a+b**	***Elephas*** **Nielsen, 1965**	***Elephas*** **Shindo + Mori, 1956a+b**	***Elephas*** **Windle + Parsons, 1901**
RHOMBOIDEUS THORACIS		**r. major** O: T4-6 I: vertebral border scapula		**rhomboides** O: T6-9 I: caudal border scapula	
OMOTRANSVERSARIUS "metacromion"	**masto-humeral, posterior portion** O: basilar part occipital I: anterior spine scapula + fascia over deltoid	**levator anguli scapulae "most forward attachment"** O: atlas I: w/ SV		**levator scapulae** O: atlas I: cranial angle scapula	
OMOTRANSVERSARIUS	**masto-humeral, third portion** O: mastoid process I: clavicular intersection	**masto-humeralis** O: mastoid process I: clavicular intersection		**cephalobrachialis/cephalo-humeralis/mastoido-brachialis in figures only**	
OMOHYOIDEUS					
SERRATUS VENTRALIS CERVICIS		**levator anguli scapulae "the lower portion"** O: C3-7, ribs 1-5 I: ? border of the scapula			**levator anguli scapulae** O: C3-7

	PROBOSCIDEA				
	Elephantidae				
	Elephas Anderson, 1883	*Elephas* Miall + Greenwood, 1878a+b	*Elephas* Nielsen, 1965	*Elephas* Shindo + Mori, 1956a+b	*Elephas* Windle + Parsons, 1901
SERRATUS VENTRALIS THORACIS		**serratus magnus** O: ribs 7-10 I: cranial angle scapula		**serratus ventralis** O: 7 digititations ribs 3-9 I: vertebral border scapula	**serratus magnus** O: ribs 1-12 I: deep surface scapula
CLAVODELTOIDEUS	**see masto-humeral** O: clavicular intersection I: H "over deltoid"	**masto-humeralis** O: clavicular intersection I: around GT			
ACROMIODELTOIDEUS	**deltoid** O: acromion				**deltoid, acromial part** O: acromion
SPINODELTOIDEUS	**deltoid** O: spine of scapula	**deltoideus** O: acromion + spine of scapula I: lateral H		**deltoides** O: acromion + spine of scapula I: D crest cranial H	
TERES MINOR		**teres minor** O: caudal border scapula I: lateral GT		**teres minor** O: caudal border scapula I: lateral GT	**subscapularis accessorius** O: caudal border scapula I: caudal H near head
SUBSCAPULARIS		**subscapularis** O: subscapular fossa I: LT		**subscapularis** O: subscapular fossa I: LT	

	PROBOSCIDEA				
	Elephantidae				
	Elephas **Anderson, 1883**	***Elephas*** **Miall + Greenwood, 1878a+b**	***Elephas*** **Nielsen, 1965**	***Elephas*** **Shindo + Mori, 1956a+b**	***Elephas*** **Windle + Parsons, 1901**
TERES MAJOR		**teres major** O: caudal angle scapula I: medial H		**teres major** O: caudal angle scapula I: neck of H	**teres major** I: medial H
LATISSIMUS DORSI		**latissimus dorsi** O: vertebral aponeurosis + ribs 9-14		**latissimus dorsi** O: vertebral aponeurosis, T14, ribs 5-13	**latissimus dorsi**
"superficial"		I: above TMA on medial H		I: above TMA on medial H	I: deep to TMA on medial H
"deep"		I: deep to TMA on medial H		I: deep to TMA on medial H	slips crossing in front of vessels
DORSO-EPITROCHLEARIS		**dorso-epitrochlearis** O: caudal angle scapula + LD + PC I: medial olecranon	**tensor fasciae antebrachii** O: caudal angle scapula I: medial olecranon	**tensor fasciae antebrachii** O: caudal angle scapula + LD + PC I: medial olecranon	**dorso-epitrochlearis** O: LD + caudal border scapula
PECTORALIS SUPERFICIALIS "clavicular"					
PECTORALIS SUPERFICIALIS	**pectoralis major, upper**	**pectoralis major, superficial**		**pectoralis major, superficial**	
"superficial"	O: sternum I: middle H	O: sternum I: middle H		O: sternum I: w/ PSd lateral DP crest to GT	

	PROBOSCIDEA				
	Elephantidae				
	Elephas **Anderson, 1883**	***Elephas*** **Miall + Greenwood, 1878a+b**	***Elephas*** **Nielsen, 1965**	***Elephas*** **Shindo + Mori, 1956a+b**	***Elephas*** **Windle + Parsons, 1901**
PECTORALIS SUPERFICIALIS "deep"	**pectoralis major, lower** O: sternum I: middle H	**pectoralis major, remaining portion** O: sternum I: lateral DP crest tp GT		**pectoralis major, (pars abdominalis)** O: sternum + external oblique I: w/ PSs lateral DP crest to GT	
PECTORALIS PROFUNDUS	**"described as pectoralis minor by Young"** O: rib 1 I: fascia over supraspinatus	**pectoralis minor** "not found" [Cuvier + Laurilard say sternum to prox H]		**pectoralis minor** "absent"	
PECTORALIS ABDOMINALIS					
SUBCLAVIUS					
STERNOSCAPULARIS					
CORACOBRACHIALIS	**coraco-brachialis** O: coracoid process I: medial H	**coraco-brachialis** O: coracoid process + GHj capsule I: cranial H	**coraco-brachialis** O: coracoid process + GHj capsule I: medial epicondyle	**coracobrachialis** O: coracoid process I: distal medial H	

	PROBOSCIDEA				
	Elephantidae				
	Elephas Anderson, 1883	*Elephas* Miall + Greenwood, 1878a+b	*Elephas* Nielsen, 1965	*Elephas* Shindo + Mori, 1956a+b	*Elephas* Windle + Parsons, 1901
CORACOBRACHIALIS					
BICEPS BRACHII, short head					
BICEPS BRACHII, long head	**biceps** O: glenoid process I: ? R	**biceps** O: w/in GHj capsule I: U	**biceps brachii** O: supraglenoid tubercle I: R	**biceps brachii** O: supraglenoid tuberosity I: U	**biceps flexor longus cubiti** O: glenoid I: U
BRACHIALIS		**brachialis anticus** O: lateral H I: U	**brachialis** O: caudo-lateral H I: U	**brachioradialis** O: caudo-lateral H I: R	
? CUBITALIS ?		**B "receives some of its lower fibres"** O: lateral supracondylar ridge			**brachialis - "a slip of the muscle"** O: lateral epicondyle
SUPRASPINATUS	**supra-spinatus**	**supraspinatus** O: supraspinous fossa I: GT		**supra spinam** O: supraspinous fossa I: GT	

	PROBOSCIDEA				
	Elephantidae				
	Elephas Anderson, 1883	*Elephas* Miall + Greenwood, 1878a+b	*Elephas* Nielsen, 1965	*Elephas* Shindo + Mori, 1956a+b	*Elephas* Windle + Parsons, 1901
INFRASPINATUS	**infra-spinatus**	**infraspinatus** O: infraspinous fossa I: distal GT		**infra spinam** O: infraspinous fossa I: distal GT	
TRICEPS BRACHII CAPUT LATERALE	**triceps**	**triceps, external** O: caudal H near GT I: w/ TLO olecranon	**triceps brachii**	**triceps brachii, laterale** O: caudal H near GT I: w/ TME olecranon	**triceps, external**
TRICEPS BRACHII CAPUT MEDIALE	**triceps**	**triceps, internal** O: medial H I: olecranon process		**triceps brachii, mediale** O: medial H I: olecranon process	**triceps, inner**
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps**	**triceps, middle/long** O: caudal border scapula I: tip of the olecranon		**triceps brachii, scapular** O: caudal border scapula I: tip of the olecranon	**triceps brachii, long head ventral**
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)	**triceps**				**triceps brachii, long head dorsal**
TRICEPS BRACHII ACCESSORY					

	PROBOSCIDEA				
	Elephantidae				
	Elephas **Anderson, 1883**	*Elephas* **Miall + Greenwood, 1878a+b**	*Elephas* **Nielsen, 1965**	*Elephas* **Shindo + Mori, 1956a+b**	*Elephas* **Windle + Parsons, 1901**
ANCONEUS		**anconoeus** O: caudal surface lateral supracondylar crest I: lateral U	**anconaeus** O: crest lateral epicondyle I: lateral U	**anconaeus** O: caudal surface lateral supracondylar crest I: lateral U	**anconeus**
BRACHIORADIALIS		**ext carpi radialis longior (supinator longus?)** O: deltoid, triceps, H I: semilunar	**brachio-radialis / supinator longus** O: lateral neck H I: os carpal intermedium		**supinator longus** present
EXT CARPI RADIALIS, longus (MC2)		**ext carpi radialis brevior** O: lateral supracondylar ridge I: base MC2 + 3	**extensor carpi radialis, long head** O: lateral supracondylar crest I: w/ ECRb base MC2 + 3	**ext carpi radialis** O: lateral supracondylar ridge I: base MC2	**ext carpi radiales longior & brevior** I: MC2
EXT CARPI RADIALIS, brevis (MC3)			**extensor carpi radialis, short head** O: more distal than ECRl I: w/ ECRl base MC2 + 3		**ext carpi radiales longior & brevior** I: MC3
EXT DIGITORUM COMMUNIS		**ext communis digitorum** O: lateral supracondylar ridge I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral supracondylar ridge + U I: digits 2, 3, 4, 5	**ext digitorum longus** O: lateral supracondylar ridge I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5

	PROBOSCIDEA				
	Elephantidae				
	Elephas **Anderson, 1883**	***Elephas*** **Miall + Greenwood, 1878a+b**	***Elephas*** **Nielsen, 1965**	***Elephas*** **Shindo + Mori, 1956a+b**	***Elephas*** **Windle + Parsons, 1901**
EXT DIGITORUM LATERALIS		**ext minimi digiti** O: lateral epicondyle, U I: base digit 5 * origin 2 heads	**ext digitorum lateralis** O: lateral epicondyle I: base digit 5 + ulnar sesamoid	**ext digitorum v proprius** O: lateral epicondyle I: base digit 5	**ext minimi digiti** O: lateral epicondyle + U I: digits 4+5
EXT CARPI ULNARIS		**ext carpi ulnaris** O: lateral epicondyle I: MC5	**ext carpi ulnaris** O: lateral epicondyle I: MC5	**ext carpi ulnaris** O: lateral epicondyle I: MC5	**ext carpi ulnaris** O: lateral epicondyle I: MC5
SUPINATOR			**supinator** absent		
ABD POLLICIS LONGUS		**ext pollicis** O: R + U I: base digit 1	**abductor longus digiti I** O: R + U I: MC1	**abductoextensor pollicis** O: U I: base digit 1	**ext ossis metacarpi pollicis** O: R + U I: MC1
EXT DIGITORUM PROFUNDUS		**ext indicis** O: lateral U I: digit 2	**extensor digitorum I et II** O: lateral epicondyle + interosseus membrane I: MC 1 + 2	**ext indicis proprius** O: lateral U I: digits 1 + 2	**ext profundus digitorum** I: digit 2
EXT BREVIS DIGITORUM					

	PROBOSCIDEA				
	Elephantidae				
	Elephas Anderson, 1883	*Elephas* Miall + Greenwood, 1878a+b	*Elephas* Nielsen, 1965	*Elephas* Shindo + Mori, 1956a+b	*Elephas* Windle + Parsons, 1901
PRONATOR TERES	**pronator teres**	**pronator radii teres** O: ligament from medial epicondyle I: middle R	**pronator teres** O: ligament from medial epicondyle I: middle R	**pronator teres** O: ligament or osseus bar from medial epicondyle I: middle R	**pronator teres** O: medial epicondyle I: R
FLX CARPI RADIALIS		**flx carpi radialis** O: medial epicondyle I: deep in carpus	**flx carpi radialis** O: medial epicondyle I: base MC1 + 2	**flx carpi radialis** O: medial epicondyle I: base MC2	**flx carpi radialis**
PALMARIS LONGUS		**palmaris longus** O: caudal medial epicondyle I: ulnar sesamoid + palm	**palmaris** O: medial epicondyle I: palmar aponeurosis	**palmaris longus** O: caudal medial epicondyle I: palmar aponeurosis	**palmaris longus** I: palmar fascia
FLX DIGITORUM SUPERFICIALIS			**flx digitorum sublimis** absent	**flx digitorum sublimis** "absent" but see **flexor digitorum brevis**, I: dig 2f	**flx sublimis digitorum** absent
INTERFLEXORII					

	PROBOSCIDEA				
	Elephantidae				
	Elephas Anderson, 1883	*Elephas* Miall + Greenwood, 1878a+b	*Elephas* Nielsen, 1965	*Elephas* Shindo + Mori, 1956a+b	*Elephas* Windle + Parsons, 1901
FLX DIGITORUM PROFUNDUS,		**flx communis digitorum**	**flx digitorum profundus, lateral humeral**	**flx digitorum longus (proprius)**	**flx profundus digitorum**
epicondylar					
epicondylar (FDPe)		O: w/ PL + FCU from caudal medial epicondyle	O: w/ PL + FCU	O: medial epicondyle	
epicondylar (FDPd)		O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle
		I: deep surface F	I: deep surface F	I: F	
ulnar		O: medial U	O: medial U	O: medial U	O: medial U
		I: deep surface F		I: F	
radial					O: R
		*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5
LUMBRICALES		**lumbricales** O: F tendon I: digits 1, 2, 3, 4	**lumbricales** O: FDP I: digits 2, 3, 4	**lumbricales** O: FDP I: digit 2, 3	**lumbricales** I: digits 2, 3, 4, 5
FLX CARPI ULNARIS,		**flx carpi ulnaris, thin and pointed**	**flx carpi ulnaris, humeral caput**	**flx carpi ulnaris**	**flx carpi ulnaris**
epitrochlear belly		O: medial epicondyle	O: medial epicondyle W/ FDP	O: caudal surface medial epicondyle	O: medial epicondyle
ulnar belly		O: medial olecranon	O: U	O: medial olecranon	O: medial olecranon
		I: pisiform	I: pisiform	I: pisiform	

	PROBOSCIDEA				
	Elephantidae				
	Elephas Anderson, 1883	*Elephas* Miall + Greenwood, 1878a+b	*Elephas* Nielsen, 1965	*Elephas* Shindo + Mori, 1956a+b	*Elephas* Windle + Parsons, 1901
EPITROCHLEO-ANCONEUS					**epitrochleo-anconeus** present
PRONATOR QUADRATUS			**pronator quadratus** absent		
PALMARIS BREVIS				**palmaris brevis** O: ulnar side palmar aponeurosis	
FLX DIGITORUM BREVIS MANUS		**flexor brevis digitorum** O: annular ligament of wrist (sheath of FCR) I: 4f, 5f, ulnar sesamoid	**flexor digitorum IV et V** O: annular ligament of wrist (sheath of FCR) I: 4f, 5f	**flexor digitorum brevis** O: annular ligament of the wrist I: 3, 4f, 5f	**flx brevis digitorum manus** median nerve I: digits 4, 5
ABD DIGITI MINIMI		**abd minimi digiti** O: annular ligament of wrist (sheath of FCR), pisiform I: ulnar sesamoid	**abd digiti V** O: pisiform I: ulnar sesamoid	**abd digiti V** O: pisiform + annular ligament of the wrist I: ulnar sesamoid	**abd minimi digiti** O: pisiform
ABD POLLICIS BREVIS					

	PROBOSCIDEA				
	Elephantidae				
	Elephas Anderson, 1883	*Elephas* Miall + Greenwood, 1878a+b	*Elephas* Nielsen, 1965	*Elephas* Shindo + Mori, 1956a+b	*Elephas* Windle + Parsons, 1901
CONTRAHENTES		**palmar interossei** O: carpus I: digit 2, 4, 5	**adductors digitorum I, II, IV, V** O: carpus I: digits 1, 2, 4, 5	**interossei volares, flexor pollicis brevis** O: carpus I: digits 1, 2, 3?, 4, 5	**oblique adductor muscles** I: digits 2, 4, 5
FLEXOR BREVES PROFUNDUS		**dorsal interossei, flx brevis pollicis, flx brevis minimi digiti, opponens minimi digiti** 9	**interossei volares I-V** 9	**opponens pollicis, abd pollicis brevis, interossei dorsales, flx digiti v proprius, opponens digiti v** 8	**interossei or flexores breves + hypothenar muscles + thenar muscles** 9
INTERMETACARPALES			**abd digiti II**		
? Unknown homology	**radio-carpus** O: R I: distal R				
RADIAL SESAMOID "PRE-POLLUX"				present	
ULNAR SESAMOID				present	
CARPAL VIBRISSAE					

	PILOSA					
	Folivora			Vermilingua		
	Bradypodidae		Megalonychidae	Cyclopedidae		Myrmecophagidae
	Bradypus **Humphry, 1869b**	***Bradypus*** **Macalister, 1869a**	***Choloepus*** **Humphry, 1869b**	***Cyclopes*** **Galton, 1869b**	***Cyclopes*** **Humphry, 1869b**	***Myrmecophaga*** **Owen, 1862**
PANNICULUS CARNOSUS		**panniculus carnosus** "weak"		**panniculus carnosus portions ventrale and laterale** I: w/ PS, LD		
STERNO-FACIALIS						
STERNOMASTOIDEUS	**sterno-mastoid** ?	**sterno-cleido-mastoid** O: paramastoid w/ CM I: sternum + rib 1	**sterno-mastoid** ?	**sterno-mastoid** O: mastoid + occiput I: sterno-clavicular joint	**sterno-mastoid** O: mastoid I: manubrium	**sternomastoideus** O: paroccipital I: manubrium
CLEIDOMASTOIDEUS		**sterno-cleido-mastoid** O: paramastoid w/ SM I: medial clavicle		**cleido-mastoid** O: mastoid + occiput I: middle clavicle	**cleido-occipital** O: occipital crest I: medial clavicle	**sternomaxillaris** O: ramus of the mandible I: manubrium
CLAVOTRAPEZIUS	**cleido-occipital** ?		**cleido-occipital** ?			
CEPHALOHUMERALIS						
ACROMIOTRAPEZIUS	**trapezius** O: C vertebrae I: clavicle, coracoid, acromion, spine scapula	**trapezius** O: C2-T6 I: acromion + spine scapula	**trapezius**	**trapezius** O: occiput, C-T vertebrae I: spine scapula + lateral clavicle	**trapezius** O: ligamentum nuchae, T1-8 I: lateral clavicle, acromion, spine scapula	
DORSO-CUTANEUS						

	PILOSA					
	Folivora			Vermilingua		
	Bradypodidae		Megalonychidae	Cyclopedidae		Myrmecophagidae
	Bradypus **Humphry, 1869b**	***Bradypus*** **Macalister, 1869a**	***Choloepus*** **Humphry, 1869b**	***Cyclopes*** **Galton, 1869b**	***Cyclopes*** **Humphry, 1869b**	***Myrmecophaga*** **Owen, 1862**
SPINOTRAPEZIUS						
RHOMBOIDEUS CAPITIS				**occipito-scapular** absent		
RHOMBOIDEUS CERVICIS	**rhomboideus**	**rhomboideus** O: C7-T3 I: "normal"		**rhomboidei** O: T vertebrae I: cranial (?posterior) surface scapula	**rhomboideus** O: C4-T5 I: vertebral border scapula	
RHOMBOIDEUS THORACIS						
OMOTRANSVERSARIUS "metacromion"	**masto-scapular** absent	**levator claviculae / trachelo-acromial** absent		**acromio-basilar / levator claviculae** absent	**masto-scapular** absent	
OMOTRANSVERSARIUS						
OMOHYOIDEUS	**omohyoid** absent	**omohyoid** absent	**omohyoid** absent	**omohyoid** absent	**omohyoid** absent	
SERRATUS VENTRALIS CERVICIS	**levator scapulae** O: C6-9	**levator scapulae** O: C6 I: cranial angle scapula		**levator scapulae** O: C5-7 I: cranial angle scapula	**levator scapulae** O: C1-7 I: deep surface vertebral border scapula	

	PILOSA					
	Folivora			Vermilingua		
	Bradypodidae		Megalonychidae	Cyclopedidae		Myrmecophagidae
	Bradypus **Humphry, 1869b**	***Bradypus*** **Macalister, 1869a**	***Choloepus*** **Humphry, 1869b**	***Cyclopes*** **Galton, 1869b**	***Cyclopes*** **Humphry, 1869b**	***Myrmecophaga*** **Owen, 1862**
SERRATUS VENTRALIS THORACIS	**serratus magnus** O: ribs 1-2; ?	**serratus magnus** O: ribs 1-8 I: distal vertebral border scapula		**serratus magnus** O: ribs 1-7 I: deep surface caudal angle + border scapula	**serratus magnus** O: rib 1; ribs 1-8 I: cranial angle scapula; deep surface caudal angle scapula	
CLAVODELTOIDEUS				**deltoid, clavicular** O: lateral clavicle + acromion I: deltoid tuberosity H	**deltoid, clavicular part** O: clavicle I: pectoral crest H	
ACROMIODELTOIDEUS		**deltoid** O: acromion + scapular spine I: middle lateral H		**deltoid, acromial** O: spine scapula I: H	**deltoid, scapular portion** O: acromion + spine scapula I: supracondyloid ridge H	
SPINODELTOIDEUS				**deltoid, spinous** O: spine scapula I: H deep to AD		
TERES MINOR	**teres minor** "nothing peculiar"	**teres minor** absent	**teres minor**	**teres minor** fused w/ IN	**teres minor** O: spine scapula I: lateral supracondyloid ridge H	

	PILOSA					
	Folivora			Vermilingua		
	Bradypodidae		Megalonychidae	Cyclopedidae		Myrmecophagidae
	Bradypus **Humphry, 1869b**	***Bradypus*** **Macalister, 1869a**	***Choloepus*** **Humphry, 1869b**	***Cyclopes*** **Galton, 1869b**	***Cyclopes*** **Humphry, 1869b**	***Myrmecophaga*** **Owen, 1862**
SUBSCAPULARIS	**subscapularis** O: subscapular fossa	**subscapularis** "normal"	**subscapularis**	**subscapularis** "usual"	**subscapularis**	
TERES MAJOR	**teres major** "as in man"	**teres major** I: not fused w/ LD	**teres major**	**teres major** O: caudal border scapula I: medial H to medial epicondyle	**teres major** O: caudal border + spine scapula I: medial H	
LATISSIMUS DORSI "superficial" "deep"	**latissimus dorsi** O: T4-L I: medial bicipital ridge	**latissimus dorsi** O: T vertebrae, lumbar fascia I: medial bicipital groove	**latissimus dorsi**	**latissimus dorsi** I: medial H I: w/ PS	**latissimus dorsi** O: T-L?, ribs 6-11 I: medial pectoral crest	
DORSO-EPITROCHLEARIS	**dorso-epitrochlien** O: LD I: medial epicondyle			**dorso-épitrochlien** O: LD I: palmar fascia	**dorso-epitrochlien** O: LD (+caudal angle scapula?) I: medial epicondyle + wrist	
PECTORALIS SUPERFICIALIS "clavicular"					**pectoralis major** O: medial clavicle + sternum I: distal pectoral crest H	
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis major** O: ? I: pectoral crest H	**pectoralis major** O: sternum, ribs 1-6, medial clavicle I: lateral bicipital groove	**pectoralis major**	**pectoralis major, uppermost strata** O: sternum I: lateral bicipital groove	**pectoralis major** O: sternum + ribs I: proximal pectoral crest H	
PECTORALIS SUPERFICIALIS "deep"						

	PILOSA					
	Folivora			Vermilingua		
	Bradypodidae		Megalonychidae	Cyclopedidae		Myrmecophagidae
	Bradypus **Humphry, 1869b**	***Bradypus*** **Macalister, 1869a**	***Choloepus*** **Humphry, 1869b**	***Cyclopes*** **Galton, 1869b**	***Cyclopes*** **Humphry, 1869b**	***Myrmecophaga*** **Owen, 1862**
PECTORALIS PROFUNDUS	**pectoralis minor** O: ribs 2-6 I: GT	**pectoralis minor** absent	**pectoralis minor**	**pectoralis minor** absent	**pectoralis minor** O: ribs 1-3 I: GT	
PECTORALIS ABDOMINALIS	**brachialis lateralis** O: rectus + external oblique I: pectoral crest H	**pectoralis quartus** O: ribs 7-8 I: lateral bicipital groove	**brachialis lateralis**	**pectoralis major,inferior strata** O: sternum, w/ PC I: lateral bicipital groove	**brachialis lateralis** O: abdomen, ribs 8-9, PC I: pectoral crest H	
SUBCLAVIUS	**subclavius** O: rib 1 I: clavicle, coracoid process	**subclavius** O: rib 1 I: deep surface acromion + clavicle	**subclavius**	**subclavius** absent	**subclavius** fused w/ PP	
STERNOSCAPULARIS						
CORACOBRACHIALIS "short variety"	**coraco-brachialis** O: base coracoid process I: medial proximal H	**coraco-brachialis (middle form)** I: proximal 1/3 H		**coraco-brachialis** absent	**coraco-brachialis** absent	
CORACOBRACHIALIS "long variety"						
BICEPS BRACHII, short head	**biceps, coracoid portion** O: coracoid I: fascia ulnar forearm					

	PILOSA					
	Folivora			Vermilingua		
	Bradypodidae		Megalonychidae	Cyclopedidae		Myrmecophagidae
	Bradypus **Humphry, 1869b**	***Bradypus*** **Macalister, 1869a**	***Choloepus*** **Humphry, 1869b**	***Cyclopes*** **Galton, 1869b**	***Cyclopes*** **Humphry, 1869b**	***Myrmecophaga*** **Owen, 1862**
BICEPS BRACHII, long head	**biceps, glenoid portion** O: glenoid I: U	**biceps, scapular** O: glenoid I: U		**biceps** O: glenoid I: R	**biceps** O: glenoid I: U w/B, R tuberosity	
BRACHIALIS	**brachialis anticus** O: cranio-lateral H I: U	**brachialis anticus** O: cranio-medial H I: R + U		**brachialis anticus** O: cranio-lateral H I: U	**brachialis anticus** O: deltoid ridge H I: U w/ BB	
CUBITALIS	**biceps, humeral portion** O: cranial H I: R tuberosity	**biceps, humeral** O: cranial H I: R				
SUPRASPINATUS	**supra-spinatus** "nothing peculiar"	**supraspinatus** "normal"	**supra-spinatus** "nothing peculiar"	**supraspinatus** "nothing of note"	**supra-spinatus** "nothing peculiar"	
INFRASPINATUS	**infra-spinatus** "nothing peculiar"	**infraspinatus** "normal"	**infra-spinatus** "nothing peculiar"	**infraspinatus** fused w/ TMI	**infra-spinatus** "nothing peculiar"	
TRICEPS BRACHII CAPUT LATERALE	**triceps** "nothing peculiar"	**triceps, humeral**		**triceps** O: lateral H I: w/ TLO	**triceps** O: distal H	
TRICEPS BRACHII CAPUT MEDIALE		**triceps, humeral**		**triceps** O: caudal H	**triceps** O: distal H	
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)		**triceps, scapular**		**triceps, long head** O: caudal border scapula I: w/ TLA	**triceps** O: near glenoid	

	PILOSA					
	Folivora			Vermilingua		
	Bradypodidae		Megalonychidae	Cyclopedidae		Myrmecophagidae
	Bradypus **Humphry, 1869b**	***Bradypus*** **Macalister, 1869a**	***Choloepus*** **Humphry, 1869b**	***Cyclopes*** **Galton, 1869b**	***Cyclopes*** **Humphry, 1869b**	***Myrmecophaga*** **Owen, 1862**
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)						
TRICEPS BRACHII ACCESSORY						
ANCONEUS	**anconeus externus** "distinct"	**anconeus externus** "distinct + large"		**anconeus** O: olecranon fossa	**anconeus externus** I: whole lateral U	
BRACHIORADIALIS	**supinator longus** O: lateral H (2 parts) I: forearm fascia; distal lateral R	**supinator longus** I: distal R + lateral ligament of wrist	**supinator longus** O: lateral H (2 parts) I: forearm fascia; distal lateral R	**supinator longus** O: ligament between deltoid tubercle and supinator ridge H I: distal R + annular ligament	**supinator longus** O: lateral H (2 parts) I: forearm fascia + radial sesamoid; distal lateral R	
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis** O: lateral epicondyle I: MC2+3	**ext carpi radialis** I: MC1+2	**ext carpi radialis** O: lateral epicondyle I: MC2+3	**ext carpi radialis** O: H distal to BR I: MC3	**ext carpi radialis** O: lateral epicondyle I: medial MC3	
EXT CARPI RADIALIS, brevis (MC3)						
EXT DIGITORUM COMMUNIS	**ext digitorum** O: lateral epicondyle I: digits 2, 3, 4	**ext digitorum communis** O: lateral epicondyle I: digits 1+2	**ext digitorum** O: lateral epicondyle I: digits 2, 3	**ext communis digitorum** O: lateral supracondyloid ridge I: digit 3	**ext digitorum** O: lateral epicondyle + U I: digit 3	

	PILOSA					
	Folivora			Vermilingua		
	Bradypodidae		Megalonychidae	Cyclopedidae		Myrmecophagidae
	Bradypus **Humphry, 1869b**	***Bradypus*** **Macalister, 1869a**	***Choloepus*** **Humphry, 1869b**	***Cyclopes*** **Galton, 1869b**	***Cyclopes*** **Humphry, 1869b**	***Myrmecophaga*** **Owen, 1862**
EXT DIGITORUM LATERALIS	**ext carpi ulnaris (2 parts)** O: lateral epicondyle I: MC4		**ext carpi ulnaris** O: lateral epicondyle + U I: digit 3	**ext minimi digiti** O: lateral supracondyloid ridge I: lateral base digit 5	**ext carpi ulnaris (2 parts)** O: lateral epicondyle I: MC3	
EXT CARPI ULNARIS	**ext carpi ulnaris (2 parts)** O: lateral epicondyle + U I: MC5	**ext carpi ulnaris** O: lateral epicondyle I: MC3	**ext carpi ulnaris** O: lateral epicondyle + U I: MC4	**ext carpi ulnaris** O: lateral epicondyle + U I: rudiment digit 5	**ext carpi ulnaris (2 parts)** O: lateral epicondyle + U I: MC4+5	
SUPINATOR	**supinator brevis** "large"	**supinator brevis** O: H I: R	**supinator brevis** "large"	**supinator brevis** O: lateral supracondyloid ridge I: lateral R	**supinator brevis** "large" I: distal R	
ABD POLLICIS LONGUS	**ext pollicis primus** O: U I: trapezium	**ext ossis metacarpi pollicis** O: U I: base MC1	**ext pollicis primus** O: U I: trapezium	**ext ossis metacarpi pollicis** O: lateral supracondyloid ridge I: rudiment digit 1 (or trapezium)	**ext pollicis primus** O: lateral epicondyle I: trapezium	
EXT DIGITORUM PROFUNDUS	**ext indicis** O: middle U I: base digit 2	**ext indicis** O: distal U I: base digit 1	**ext indicis** O: middle U I: base digit 2		**ext indicis** O: distal U I: digit 2	
EXT BREVIS DIGITORUM	**ext brevis digitorum** O: dorsal carpus I: w/ EDC digits 2, 3, 4	**ext brevis digitorum manus** O: dorsum hand I: w/ EDC	**ext brevis digitorum** O: dorsal MC2+3 I: EDC digits 2, 3	**ext brevis digitorum manus** O: distal U + magnum + unciform I: digits 2+3	**ext brevis digitorum** O: dorsal carpus I: digit 3	

	PILOSA					
	Folivora			Vermilingua		
	Bradypodidae		Megalonychidae	Cyclopedidae		Myrmecophagidae
	Bradypus **Humphry, 1869b**	***Bradypus*** **Macalister, 1869a**	***Choloepus*** **Humphry, 1869b**	***Cyclopes*** **Galton, 1869b**	***Cyclopes*** **Humphry, 1869b**	***Myrmecophaga*** **Owen, 1862**
PRONATOR TERES	**pronator teres** O: medial epicondyle I: distal R	**pronator teres** O: medial epicondyle I: distal R + carpus	**pronator teres** O: medial epicondyle I: distal R	**pronator teres** O: medial epicondyle I: distal R	**pronator teres** O: medial epicondyle I: distal R	
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: rudimentary MC1	**flx carpi radialis** O: medial epicondyle I: MC1 + trapezium	**flx carpi radialis** O: medial epicondyle I: scaphoid	**flx carpi radialis** O: medial epicondyle	**flx carpi radialis** O: medial epicondyle I: base MC2	
PALMARIS LONGUS	**palmaris longus** O: medial epicondyle I: scaphoid	**palmaris longus** O: medial epicondyle I: palmar fascia, pisiform, unciform	**palmaris longus** O: medial epicondyle I: digits 3+4	**palmaris longus** O: olecranon I: palmar fascia	**palmaris longus** w/ FCU	
FLX DIGITORUM SUPERFICIALIS	**flx digitorum sublimis** O: FDPe I: digits 2, 3		**flx digitorum sublimis** O: surface FDP I: deep surface PL tendons over MCPj	**flx sublimis (?)** O: medial epicondyle, FDPe I: digits 2+3, annular ligament	**flx digitorum sublimis** O: medial epicondyle + FDP (2 parts) I: digits 2, 3	
INTERFLEXORII						

	PILOSA					
	Folivora			Vermilingua		
	Bradypodidae		Megalonychidae	Cyclopedidae		Myrmecophagidae
	Bradypus **Humphry, 1869b**	***Bradypus*** **Macalister, 1869a**	***Choloepus*** **Humphry, 1869b**	***Cyclopes*** **Galton, 1869b**	***Cyclopes*** **Humphry, 1869b**	***Myrmecophaga*** **Owen, 1862**
FLX DIGITORUM PROFUNDUS,	**flx digitorum profundus**	**flx digitorum**	**flx digitorum profundus**	**flx profundus**	**flx digitorum profundus**	
epicondylar						
epicondylar (FDPe)	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	
epicondylar (FDPd)						
ulnar	O: U	O: U	O: U	O: medial U	O: U	
radial	O: R *I: digits 2, 3, 4	O: R "single mass"	O: R *I: digits 3+4	O: R *I: digits 2+3	O: R *I: digits 2+3	
LUMBRICALES	**lumbricales** absent	**lumbricales** absent	**lumbricales** O: FDP I: medial digits 3+4	**lumbricales** O: FDP I: medial digits 3+4	**lumbricales** absent	
FLX CARPI ULNARIS, epitrochlear belly	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris?** O: medial epicondyle	**flx carpi ulnaris** O: medial epicondyle	
ulnar belly	O: medial U I: pisiform, U, palmar fascia / pisiform	O: olecranon I: pisiform, unciform, annular ligament, MC3	O: medial U I: MC4+5	O: U (2 heads) I: pisiform	O: medial U I: pisiform, U, palmar fascia / pisiform	
EPITROCHLEO-ANCONEUS	**anconeus internus** "distinct"	**epitrochleo-anconeus** O: medial epicondyle I: olecranon		**epitrochleo-anconeus** O: medial epicondyle I: olecranon	**anconeus internus** O: caudal medial epicondyle	
PRONATOR QUADRATUS	**pronator quadratus** O: U + R	**pronator quadratus** O: distal 1/6 R	**pronator quadratus** O: U + R	**pronator quadratus** O: entire R + U	**pronator quadratus** "whole interosseus space"	
PALMARIS BREVIS						

	PILOSA					
	Folivora			Vermilingua		
	Bradypodidae		Megalonychidae	Cyclopedidae		Myrmecophagidae
	***Bradypus* Humphry, 1869b**	***Bradypus* Macalister, 1869a**	***Choloepus* Humphry, 1869b**	***Cyclopes* Galton, 1869b**	***Cyclopes* Humphry, 1869b**	***Myrmecophaga* Owen, 1862**
FLX BREVIS MANUS				**"large mass of muscle"** O: pisiform I: digits 1, 4, 5		
ABD DIGITI MINIMI						
ABD POLLICIS BREVIS		**abd primi digiti** O: scaphoid + annular ligament I: digit 1				
CONTRAHENTES			**interossei** O: pisiform I: digit 2			
FLEXOR DIGITORUM BREVES PROFUNDUS	**interossei** 8		**interossei** 4	**interossei** 5	**interossei** 2	
INTERMETACARPALES						
? Unknown homology		**subscapulo-humeral** O: deep surface caudal border scapula near glenoid I: distal LT				
? Unknown homology						
RADIAL SESAMOID "PRE-POLLUX"						
ULNAR SESAMOID CARPAL VIBRISSAE						

	CINGULATA				
	Dasypodidae				
	Chlamyphorus **Macalister, 1875a**	***Dasypus*** **Miles, 1941**	***Dasypus*** **Linkinhoker, 1997**	***Euphractus*** **Galton, 1869a**	***Tolypeutes*** **Murie, 1872b**
PANNICULUS CARNOSUS	**panniculus carnosus** "fibers over scapula"	**panniculus carnosus** O: playsma I: carapace, fascia over deltoid			**panniculus carnosus** "feebly developed" I: skin over axilla
STERNO-FACIALIS					
STERNOMASTOIDEUS	**sterno-mastoid** O: paroccipital I: manubrium	**sternomastoideus** O: mastoid w/ CM I: manubrium		**sterno-mastoid** O: mastoid process I: manubrium + opposite partner	**sterno-mastoid, sternal segment** O: mastoid process I: manubrium + opposite partner
CLEIDOMASTOIDEUS	**cleido-mastoid** O: paroccipital I: clavicle	**cleidomastoideus, "more medial slip"** O: mastoid w/ SM I: medial clavicle		**cleido-mastoid** O: mastoid process I: medial clavicle	**sterno-mastoid, cleidal segment** O: mastoid process I: medial clavicle
CLAVOTRAPEZIUS	**cleido-occipital** O: ex-occipital, EAM I: middle clavicle	**cleidomastoideus, "lateral slip"** O: lambdoidal ridge I: medial clavicle		**levator claviculae** O: occipito-parietal region I: lateral clavicle	
CEPHALOHUMERALIS				SM superficial to PS	
ACROMIOTRAPEZIUS	**trapezius superior** O: carapace, C vertebrae I: clavicle, acromion, spine scapula	**trapezius superficial** O: carapace, C vertebrae I: acromion, spine scapula, SD		**trapezius upper** O: C midline I: acromion + spine scapula; portion lost in fascia shoulder	**protractor of the first movable zone** O: anterior scutes I: spine scapula
DORSO-CUTANEUS					

	CINGULATA				
	Dasypodidae				
	Chlamyphorus **Macalister, 1875a**	***Dasypus*** **Miles, 1941**	***Dasypus*** **Linkinhoker, 1997**	***Euphractus*** **Galton, 1869a**	***Tolypeutes*** **Murie, 1872b**
SPINOTRAPEZIUS	**trapezius inferior** O: T + L vertebrae I: base spine scapula	**trapezius deep** O: T vertebrae I: spine scapula		**trapezius lower** O: T3-L? Vertebrae I: base spine scapula	**trapezius** O: T1-7
RHOMBOIDEUS CAPITIS	**r. capitis** O: occiput I: spine scapula	**r. pars capitis** O: lambdoidal crest I: cranial angle scapula		**occipito-scapular** O: occipital crest I: cranial angle scapula + fascia S	**r. capitis** O: C vertebrae I: supraspinous fossa
RHOMBOIDEUS CERVICIS	**r. minor** O: C vertebrae I: base scapula	**r. pars thoracic** O: lateral aponeurosis I: vertebral border scapula		**rhomboidei** O: T1-6 + dorsal aponeurosis I: vertebral border scapula	**r. major and minor** O: T2-5 I: vertebral border scapula
RHOMBOIDEUS THORACIS					
OMOTRANSVERSARIUS "metacromion"	**acromio-trachelian** absent			**acromio-basilar** O: supraoccipital I: metacromion process	**"small roundish muscle"** O: skull I: metacromion
OMOTRANSVERSARIUS					
OMOHYOIDEUS	**omohyoid** absent			**omohyoid** absent	
SERRATUS VENTRALIS CERVICIS	**levator anguli scapula** O: C vertebrae w/ SVT I: w/ SVT	**levator scapulae** absent (see SVT)		**levator scapulae** O: C vertebrae I: cranial angle + border scapula	

	CINGULATA				
	Dasypodidae				
	Chlamyphorus Macalister, 1875a	*Dasypus* Miles, 1941	*Dasypus* Linkinhoker, 1997	*Euphractus* Galton, 1869a	*Tolypeutes* Murie, 1872b
SERRATUS VENTRALIS THORACIS	**serratus magnus** O: ribs 1-7 I: vertebral border scapula	**serratus anterior** O: ribs 1-6, C2-3 I: vertebral border scapula		**serratus magnus (2 parts)** O: ribs 1-2 + ribs 3-6 I: caudal angle scapula	
CLAVODELTOIDEUS	**deltoideus scapularis** O: lateral clavicle I: deltoid crest H	**deltoideus, clavicular portion** O: clavicle I: deltoid ridge H		**deltoid, clavicular** O: lateral clavicle I: oval facet lateral deltoid trochanter H	**deltoid** O: lateral clavicle I: lateral H neck + deltoid process
ACROMIODELTOIDEUS	**acromial deltoid** O: acromion + coraco-acromial ligament I: deltoid crest H	**deltoideus, acromial portion** O: acromion I: deltoid ridge H		**deltoid, acromial** O: acromion I: w/ CD oval facet lateral deltoid trochanter H	**deltoid** O: acromion I: lateral H neck + deltoid process
SPINODELTOIDEUS	**scapular deltoid proper** O: spine scapula I: deltoid crest H	**deltoideus** O: vertebral border + spine scapula I: deltoid ridge H		**deltoid, scapular** O: spine scapula I: deltoid ridge H	**deltoid** O: spine scapula I: lateral H neck + deltoid process
TERES MINOR	**teres minor** O: post-scapular ridge I: deep to IN	**teres minor** O: w/ IN I: GT deep to IN		**teres minor** O: lesser spine scapula I: projection distal GT	**teres minor** "rudimentary"

	CINGULATA				
	Dasypodidae				
	Chlamyphorus **Macalister, 1875a**	***Dasypus*** **Miles, 1941**	***Dasypus*** **Linkinhoker, 1997**	***Euphractus*** **Galton, 1869a**	***Tolypeutes*** **Murie, 1872b**
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: proximal to TMA ins	**subscapularis** O: subscapular fossa I: LT		**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT
TERES MAJOR	**teres major** O: caudal border scapula + SS I: distal to SS	**teres major** O: caudal border scapula I: bicipital groove H		**teres major** O: near caudal angle scapula I: H distal to LD	**teres major** O: near caudal angle scapula I: H distal to LD
LATISSIMUS DORSI "superficial" "deep"	**latissimus dorsi (2 parts)** O: 5 ribs / 3T-L2 I: medial H I: caudal angle scapula	**latissimus dorsi** O: ribs 5-8 I: bicipital groove H + PA		**latissimus dorsi (2 parts)** O: L vertebrae + aponeurosis, ribs 5-9+ I: medial H proximal to TMA I: w/ PS	**latissimus dorsi** O: ribs 2-5, caudal border scapula I: shaft H
DORSO-EPITROCHLEARIS	**dorsi-epitrochlear** O: LD I: medial epicondyle + olecranon, fascia forearm	**dorso-epitrochlearis** O: LD I: TLO + medial forearm		**dorso-epitrochlien** O: LD + caudal angle scapula I: fasica of elbow, fascia of forearm	**dorsi epitrochlear** O: T6-8 + caudal border scapula I: fascia olecranon
PECTORALIS SUPERFICIALIS "clavicular"	**great pectoral, clavicular part** O: medial clavicle I: w/ PSs pectoral crest H				
PECTORALIS SUPERFICIALIS "superficial"	**great pectoral, sternal portion** O: sternum I: w/ PSc pectoral crest H	**pectoralis major** O: sternum I: distal GT		**pectoralis major** O: manubrium sternum, rectus sheath I: medial deltoid trochanter H	**pectoralis major** O: manubrium + sternum I: medial deltoid process
PECTORALIS SUPERFICIALIS "deep"					

	CINGULATA				
	Dasypodidae				
	Chlamyphorus **Macalister, 1875a**	*Dasypus* **Miles, 1941**	*Dasypus* **Linkinhoker, 1997**	*Euphractus* **Galton, 1869a**	*Tolypeutes* **Murie, 1872b**
PECTORALIS PROFUNDUS	**pectoralis quartus** O: 2 ribs I: H (superficial to bp)			**pectoralis minor** absent	**pectoralis minor** O: ribs 5-6 I: over biceps tendon
PECTORALIS ABDOMINALIS	**great pectoral, abdominal portion** O: linea alba I: LT + deltoid crest H	**pectoralis abdominalis** O: rectus abdominalis I: GT, coracoid process			
SUBCLAVIUS	**subclavius** O: rib 1 I: clavicle, coracoid, acromion	**pectoralis minor** O: rib 1 I: acromion		**subclavius** O: rib 1 I: acromion + fascia S	**subclavius** O: rib 1 I: clavicle, coracoid, acromion
STERNOSCAPULARIS	**retro-clavicularis** O: ribs 1 I: acromion + fascia S			**subclavius** "splits around the coraco-clavicular ligament"	
CORACOBRACHIALIS "short variety"	**coraco-brachialis** O: coracoid process	**coracobrachialis** O: coracoid process I: distal medial H + medial epicondyle		**coraco-brachialis** O: coracoid process I: GHj capsule near LT	
CORACOBRACHIALIS "long variety"				**coraco-brachialis** O: coracoid process I: w/ BB, H near supracondyloid foramen	**coraco-brachialis** O: coracoid process I: medial supracondyloid arch
BICEPS BRACHII, short head					**biceps** O: coracoid I: fossa near coronoid process U

	CINGULATA				
	Dasypodidae				
	Chlamyphorus **Macalister, 1875a**	***Dasypus*** **Miles, 1941**	***Dasypus*** **Linkinhoker, 1997**	***Euphractus*** **Galton, 1869a**	***Tolypeutes*** **Murie, 1872b**
BICEPS BRACHII, long head	**biceps** O: glenoid margin I: U fossa near coronoid process	**biceps brachii** O: glenoid + coracoid I: U		**biceps** O: glenoid I: neck R + fossa medial U w/ B	**biceps** O: scapular I: U fossa near coronoid process
BRACHIALIS	**brachialis anticus** O: fossa lateral H I: fossa near coronoid process	**brachialis** O: caudolateral H I: U		**brachialis anticus** O: neck H + lateral H I: fossa medial U w/ BB	**brachialis anticus** O: neck H I: fossa near coronoid process U
CUBITALIS					
SUPRASPINATUS	**supraspinatus** O: supraspinous fossa	**supraspinatus** O: supraspinous fossa I: GT		**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT
INFRASPINATUS	**infraspinatus** "as usual"	**infraspinatus** O: infraspinous fossa I: GT		**infraspinatus** O: interspinous fossa I: GT	**infraspinatus** O: interspinous fossa I: GT
TRICEPS BRACHII CAPUT LATERALE	**triceps, third part** O: caudal border scapula I: olecranon	**triceps brachii, caput humeri** O: caudal H I: olecranon		**triceps, external humeral factor** O: neck H I: w/ TLO olecranon, fascia of arm	**long humeral division triceps**
TRICEPS BRACHII CAPUT MEDIALE	**triceps, humeral origin**			**triceps, internal humeral** O: medial shaft H I: caudo-medial olecranon	**third shorter head triceps** O: medial H
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps, posterior long head** O: caudal border scapula I: tip olecranon	**triceps brachii, caput scapularis** O: caudal border scapula I: olecranon		**triceps, scapular "another element"** O: ridge on caudal border scapula near neck I: w/ TLA + TLO caudal olecranon	**scapular head of triceps** O: w/ D-E I: olecranon

	CINGULATA				
	Dasypodidae				
	Chlamyphorus **Macalister, 1875a**	***Dasypus*** **Miles, 1941**	***Dasypus*** **Linkinhoker, 1997**	***Euphractus*** **Galton, 1869a**	***Tolypeutes*** **Murie, 1872b**
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)	**triceps, second part** O: caudal border scapula I: olecranon	**triceps brachii, caput scapularis** "deep fissure partially divides the muscle"		**triceps, scapular** O: lesser spine scapula I: w/ TLA + TLO caudal olecranon	
TRICEPS BRACHII ACCESSORY					
ANCONEUS	**anconeus externus** slip deep to TLA			**anconeus** O: olecranon fossa I: cranial surface olecranon	**anconeus externus**
BRACHIORADIALIS	**supinator longus** absent			**supinator longus** absent	
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis** O: lateral condyloid ridge I: MC2 + R		**extensor carpi radialis** O: supracondylar ridge I: MC2, MC3	**ext carpi radialis** O: supinator ridge I: MC2+3	**ext carpi radialis longior et brevior** O: lateral epicondyle I: trapezium-trapezoid
EXT CARPI RADIALIS, brevis (MC3)					**ext carpi radialis longior et brevior** O: lateral epicondyle I: MC2+3
EXT DIGITORUM COMMUNIS	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4		**extensor digitorum communis** O: supracondylar ridge & lateral epicondyle I: distal phalanges dig 2 (slip), 3, 4	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4	**ext communis digitorum** O: lateral epicondyle I: digits 3+4

	CINGULATA				
	Dasypodidae				
	Chlamyphorus **Macalister, 1875a**	***Dasypus*** **Miles, 1941**	***Dasypus*** **Linkinhoker, 1997**	***Euphractus*** **Galton, 1869a**	***Tolypeutes*** **Murie, 1872b**
EXT DIGITORUM LATERALIS	**ext annularis + ext minimi digiti proprius** O: lateral epicondyle I: digits 4+5 / digit 5		**extensor digiti IV proprius** O: lateral epicondyle I: digit 4	**ext annularis + ext minimi digiti** O: supracondyloid ridge H I: digit 4, 5; MC5 * 2 bellies	**ext medius digiti + ext minimi digiti** O: lateral epicondyle I: digits 3+4
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle I: base MC5		**extensor carpi ulnaris** O: lateral epicondyle I: pisiform	**ext carpi ulnaris** O: supinator ridge H + U I: MC5 (sesamoid)	
SUPINATOR	**supinator brevis** "few short fibers"		**supinator** O: fossa lateral epicondyle I: cranio-medial R	**supinator brevis** O: tubercle lateral epicondyle I: middle R	**supinator** I: neck R
ABD POLLICIS LONGUS	**ext ossis metacarpi pollicis** O: U I: MC1		**abductor pollicis longus** O: lateral fossa olecranon I: trapezium & base MC1	**ext ossis metacarpi pollicis** O: U + interosseus septum I: base MC1 + sesamoid	**ext ossis metacarpi** O: U + interosseus membrane I: trapezium
EXT DIGITORUM PROFUNDUS	**ext indicis** O: U I: digit 2		**extensor indicis** O: lateral fossa olecranon I: base distal phalanx digit 2	**ext indicis** O: U I: digits 1+2	**ext indicis** O: U I: digit 2
EXT BREVIS DIGITORUM	**ext brevis** O: U I: EDC + digit 2+3				

	CINGULATA				
	Dasypodidae				
	Chlamyphorus **Macalister, 1875a**	***Dasypus*** **Miles, 1941**	***Dasypus*** **Linkinhoker, 1997**	***Euphractus*** **Galton, 1869a**	***Tolypeutes*** **Murie, 1872b**
PRONATOR TERES	**pronator radii teres** O: medial supracondyloid process I: distal R		**pronator teres** O: medial epicondyle I: cranial crest of R	**pronator teres** O: medial epicondyle I: distal R	**pronator radii teres** O: medial epicondyle I: distal R
FLX CARPI RADIALIS	**flx carpi radialis** O: medial supracondyloid process I: base MC1		**flexor carpi radialis** O: medial epicondyle I: tubercle base MC2	**flx carpi radialis** O: medial epicondyle I: fused trapezium-trapezoid	**flx carpi radialis** O: medial epicondyle I: fused trapezium-trapezoid
PALMARIS LONGUS	**palmaris longus** O: medial epicondyle I: four slips to digits		**flexor digitorum sublimis** O: medial epicondyle I: base distal phalanx 1, middle phalanx 2 + 3 (flexor sheath)	**flx sublimis digitorum** O: medial epicondyle I: palmar fascia (digits 2+3)	**palmaris longus** O: medial epicondyle I: palmar fascia + FDP sesamoid
FLX DIGITORUM SUPERFICIALIS	**flx sublimis** O: medial epicondyle I: medial FDP sesamoid				**flx sublimis** O: medial epicondyle I: FDP sesamoid
INTERFLEXORII					

	CINGULATA				
	Dasypodidae				
	Chlamyphorus **Macalister, 1875a**	***Dasypus*** **Miles, 1941**	***Dasypus*** **Linkinhoker, 1997**	***Euphractus*** **Galton, 1869a**	***Tolypeutes*** **Murie, 1872b**
FLX DIGITORUM PROFUNDUS,	**flx profundus digitorum + flx pollicis longus**		**flexor digitorum profundus**	**flx profundus digitorum**	**flx profundus digitorum**
epicondylar				O: medial epicondyle O: coronoid fossa H	O: sigmoid notch U
epicondylar (FDPe)			O: medial epicondyle	O: medial epicondyle I: sesamoid	O: medial epicondyle
epicondylar (FDPd)	O: olecranon			O: medial U I: sesamoid	O: sigmoid notch U
ulnar	O: middle U		O: medial fossa olecranon + U shaft I: sesamoid	O: medial U I: sesamoid	O: medial U
radial	O: R *I: digits 1-5		O: medial R I: sesamoid *I: distal phalanges 2, 3, 4	O: neck R I: sesamoid *I: digits 1-5	O: shaft ?R *I: digits 2, 3, 4
LUMBRICALES	**lumbricales** O: FDP I: digits 3, 4, 5		**lumbricales** 3 R+ U sides dig 2, R dig 4	**lumbricales** O: sesamoid of FDP I: lateral digits 1 + 2, radial digits 2, 4, 5	
FLX CARPI ULNARIS, epitrochlear belly	**flx carpi ulnaris** O: medial epicondyle		**flexor carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**
ulnar belly	O: olecranon I: pisiform		O: U + olecranon I: pisiform & base MC4	O: medial olecranon I: pisiform	O: olecranon I: pisiform
EPITROCHLEO-ANCONEUS	**epitrochleo-anconeus** "as usual"	**triceps anconeus (internus) r+u** O: medial epicondyle I: medial olecranon	**epitrochleo-anconeus** O: tubercle on medial olecranon I: medial epicondyle	**epitrochleo-anconeus** O: medial epicondyle I: olecranon	**anoneus internus**
PRONATOR QUADRATUS	**pronator quadratus** "exceedingly feeble fibrous band"			**pronator quadratus** absent	**pronator quadratus** absent
PALMARIS BREVIS					

	CINGULATA				
	Dasypodidae				
	Chlamyphorus Macalister, 1875a	*Dasypus* Miles, 1941	*Dasypus* Linkinhoker, 1997	*Euphractus* Galton, 1869a	*Tolypeutes* Murie, 1872b
FLX BREVIS MANUS					**flx brevis manus** O: FDP sesamoid I: medial + lateral digit 2
ABD DIGITI MINIMI	**abductor little finger**		**see flexor carpi ulnaris** O: pisiform I: dig 5	**abd minimi digiti** O: pisiform I: MC5	
ABD POLLICIS BREVIS			- - -		
CONTRAHENTES			**contrahentes** O: base MC I: L1, L2, M4	**interossei + abd pollicis** I: digits 1, 2, 4	
FLEXOR DIGITORUM BREVES PROFUNDUS	**interossei, abd pollicis, opponens pollicis, flx brevis pollicis, add pollicis** 7		**interossei + abuctor pollicis brevis** 6	**flx brevis digiti quinti, opponens pollicis, flx brevis pollicis, interossei** 7	
INTERMETACARPALES			-		
? Unknown homology	**subscapulo-humeral** absent		**?** base MC2-MC4		**retractor of scapular shield** O: cranial angle scapula I: pectoral shield
? Unknown homology	**flx carpi radialis brevis (radio-carpeus)**				
RADIAL SESAMOID "PRE-POLLUX"				present	
ULNAR SESAMOID CARPAL VIBRISSAE					

	Erinaceomorpha					
	Erinaceidae					
	Erinaceus **Dobson, 1882b**	***Erinaceus*** **Julien, 1967**	***Erinaceus*** **Neveu & Gasc, 2002**	***Echinosorex*** **Dobson, 1881**	***Echinosorex*** **Neveu & Gasc, 2002**	***Echinosorex*** **Parsons, 1898a**
PANNICULUS CARNOSUS	**humero-dorsalis, humero-lateralis** O: back + sides, elbow I: bicipital groove, tip acromion			**panniculus carnosus** O: back + sides I: fascia BB + bicipital groove		
STERNO-FACIALIS						
STERNOMASTOIDEUS	**sterno-mastoid** O: mastoid process I: sternum	**sterno-mastoïdien** O: post-tympanic crest I: sternum + sterno-clavicular ligament	**sterno-mastoideus** O: mastoid w/CM I: distal sternum	**sterno-mastoid** O: mastoid process I: sternum	**sterno-mastoideus** O: mastoid w/CM I: distal sternum	
CLEIDOMASTOIDEUS	**cleido-mastoid** O: occipital crest I: middle clavicle	**cléido-mastoïdien** O: post-tympanic crest I: lateral clavicle	**cleido-mastoideus** O: mastoid w/SM I: clavicle proximal to CT	**cleido-mastoid** O: mastoid process I: middle clavicle	**cleido-mastoideus** O: mastoid w/SM I: clavicle proximal to CT	**cleido-mastoid**
CLAVOTRAPEZIUS	**cleido-occipital** O: occipital crest I: lateral clavicle	**cléido-occipital** O: occipital crest I: medial clavicle	**cleido-occipitalis** O: occipital crest I: clavicle distal to CM	**cleido-occipital** O: w/ AT occipital crest I: lateral clavicle	**cleido-occipitalis** O: occipital crest I: clavicle distal to CM	**trapezius, occipital fibers** O: occiput I: clavicle
CEPHALOHUMERALIS						
ACROMIOTRAPEZIUS	**trapezius anterior** O: occipital crest, ligamentum nuchae, T1-2 I: acromion + scapular spine	**trapèze antérieur** O: occipital crest, ligamentum nuchae, T1 I: spine scapula	**trapezius anterior** O: occipital crest, ligamentum nuchae, T1 I: scapular spine & metacromion	**trapezius anterior** O: occipital crest, ligamentum nuchae, T1-2 I: acromion + scapular spine	**trapezius anterior** O: occipital crest, ligamentum nuchae, T1-4 I: scapular spine & metacromion	**trapezius** O: ligamentum nuchae, T1-4 I: scapular spine & metacromion
DORSO-CUTANEUS						
SPINOTRAPEZIUS	**trapezius posterior** O: last 6T I: posterior scapular spine	**trapèze postérieur** O: last 4T I: posterior scapular spine	**trapezius posterior** O: last 2 T vert I: diist 1/3 scap spine	**trapezius posterior** O: last 5T I: posterior scapular spine	**trapezius posterior** O: last 2 T vert I: base spine scapula	**trapezius** O: last 3 T vert I: base spine scapula

	Erinaceomorpha					
	Erinaceidae					
	Erinaceus **Dobson, 1882b**	***Erinaceus*** **Julien, 1967**	***Erinaceus*** **Neveu & Gasc, 2002**	***Echinosorex*** **Dobson, 1881**	***Echinosorex*** **Neveu & Gasc, 2002**	***Echinosorex*** **Parsons, 1898a**
RHOMBOIDEUS CAPITIS	**r. anticus** O: occipital crest, ligamentum nuchae, T1-5 I: base scapular spine	**r. occipital** O: occipital crest I: (dorsal) root of spine + vertebral border scapula	**r. capitis et cervicis** O: occipital crest, ligamentum nuchae, 1T vert I: vertebral border scapula	**r. anticus** O: occipital crest, ligamentum nuchae, T1-5 I: vertebral border scapula	**r. capitis et cervicis** O: occipital crest, ligamentum nuchae I: spine scapula	**r. capitis et colli** O: occiput, ligamentum nuchae I: spine + vertebral border scapula
RHOMBOIDEUS CERVICIS		**r. cervical** O: ligamentum nuchae + T1-5 I: proximal vertebral border scapula				
RHOMBOIDEUS THORACIS	**r. posticus** O: T5-6 I: vertebral border scapula	**r. dorsal** O: T15-16 I: distal vertebral border	**r. dorsi** O: 2-3T verts I: vertebral border scapula	**r. posticus** O: T4-6 I: vertebral border scapula	**r. dorsi** O: T1-5 verts I: vertebral border scapula	**r. thoracis** O: T1-5 I: caudal vertebral border scapula
OMOTRANSVERSARIUS	**levator scapulae** O: atlas I: tip acromion	**acromio-trachélien** O: atlas I: metacromion	**omotransversarius** O: atlas I: metacromion	**levator scapulae** O: atlas I: tip acromion	**omotransversarius** O: atlas I: metacromion	**omo-trachelian** O: atlas I: metacromion
OMOTRANSVERSARIUS				**cervico-humeral of Humphry** O: atlas I: w/ RO	**rhomboideus profundus** O: atlas I: base spine scapula	**r. profundus** O: atlas I: spine scapula
OMOHYOIDEUS	**omo-hyoid** O: hyoid I: cranial neck scapula			**omo-hyoid** "usual"	**omohyoid** O: hyoid I: cranial border scapula near coracoid	**omo-hyoid** O: hyoid I: cranial border scapula near coracoid
SERRATUS VENTRALIS CERVICIS	**levator angulae scapulae** O: C2-7 I: deep surface near cranial angle scapula	**elévator de l'omoplate** O: C vert I: deep surface near cranial angle	**serratus ventralis cervicis** O: C3-7 I: deep surface vertebral border scapula	**levator angulae scapulae** O: C4-6 I: w/ SVT near cranial angle scapula	**serratus ventralis cervicis** O: C3-7 I: vertebral border scapula	**levator anguli scapulae** O: C3-7
SERRATUS VENTRALIS THORACIS	**serratus magnus** O: ribs 1-9 I: deep surface vertebral border	**grand dentelé** O: ribs via 9 digitations I: deep surface vertebral border	**serratus ventralis thoracis** O: ribs I: deep surface vertebral border scapula	**serratus magnus** O: ribs 1-10 I: w/ SVC near cranial angle scapula	**serratus ventralis thoracis** O: ribs 1-8 I: vertebral border scapula	**serratus magnus** O: ribs 1-8
CLAVODELTOIDEUS	**deltoideus** O: clavicle	**cléido-deltoïde** O: clavicle I: distal DP crest	**deltoideus pars clavicularis** O: lateral clavicle I: DP crest	**pectoralis major, clavicular part** O: lateral clavicle I: bicipital groove	**deltoideus pars clavicularis** O: lateral clavicle I: DP crest	**deltoid, clavicular head** O: lateral clavicle I: deltoid ridge

	Erinaceomorpha					
	Erinaceidae					
	Erinaceus **Dobson, 1882b**	***Erinaceus*** **Julien, 1967**	***Erinaceus*** **Neveu & Gasc, 2002**	***Echinosorex*** **Dobson, 1881**	***Echinosorex*** **Neveu & Gasc, 2002**	***Echinosorex*** **Parsons, 1898a**
ACROMIODELTOIDEUS	**deltoideus** O: acromion I: w/ SD DP crest	**acromio-deltoïde** O: acromion I: DP crest	**deltoideus pars acromialis** O: acromion I: DP crest	**deltoideus, external** O: coracoid process + acromion I: cranial H	**deltoideus pars acromialis** O: acromion I: DP crest	**deltoid, acromial head** O: between acromion + metacromion I: deltoid ridge
SPINODELTOIDEUS	**deltoideus** O: spine scapula I: w/ AD DP crest	**spino-deltoïde** O: spine scapula I: lateral DP crest	**deltoideus pars spinalis** O: spine scapula I: DP crest	**deltoideus, internal** O: spine scapula I: cranial H	**deltoideus pars spinalis** O: spine scapula I: DP crest	**deltoid, spinous head** O: spine scapula I: deltoid ridge
TERES MINOR	**teres minor** O: w/ IN I: w/ IN lateral GT	**petit rond** O: neck scapula I: lateral GT	**teres minor** O: caudal border scapula I: lateral GT	**teres minor** "no trace"	**teres minor** O: caudal border scapula I: lateral GT	
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT	**sous-scapulaire** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT
TERES MAJOR	**teres major** O: caudal angle scapula I: w/ LD medial H	**grand rond** O: caudal angle scapula I: w/ LD prox 1/3 medial H	**teres major** O: caudal border scapula I: medial H	**teres major** O: caudal angle scapula I: w/ LD medial H	**teres major** O: caudal border scapula I: medial H	**teres major** O: caudal angle scapula I: w/ LD medial H
LATISSIMUS DORSI	**latissimus dorsi** O: last 6T + L1-3 verts I: w/ TMA medial H * 2 tendons insertion	**grand dorsal** O: last T + L1 vert I: w/ TMA medial H	**latissimus dorsi** O: thoracolumbar fascia I: proximal medial H	**latissimus dorsi** O: last 4T verts I: w/ TMA medial H	**latissimus dorsi** O: thoracolumbar fascia I: proximal medial H	
DORSO-EPITROCHLEARIS	**dorso-epitrochlearis** O: LD I: medial olecranon	**dorso-épitrochléo-olécrânien** O: LD I: medial olecranon	**dorso-epitrochlearis** O: LD I: medial olecranon	**dorso-epitrochlearis** O: LD I: medial olecranon	**dorso-epitrochlearis** O: LD I: medial olecranon	
PECTORALIS SUPERFICIALIS "clavicular"	**pectoralis major, clavicular part** O: lateral clavicle I: distal DP crest					
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis major, sternal** O: sternum I: length of H, slip spans BB tendon	**grand pectoral, sternal anterieure** O: sternum I: distal DP crest	**pectoralis, clavicular** O: sternum I: DP ridge H	**pectoralis major, anterior sternal** O: sternum + ventral raphe I: length of H	**pectoralis, clavicular** O: sternum I: DP ridge H	**pectoralis major, anterior sternal** O: sternum + ventral raphe I: length of H

	Erinaceomorpha					
	Erinaceidae					
	Erinaceus **Dobson, 1882b**	***Erinaceus*** **Julien, 1967**	***Erinaceus*** **Neveu & Gasc, 2002**	***Echinosorex*** **Dobson, 1881**	***Echinosorex*** **Neveu & Gasc, 2002**	***Echinosorex*** **Parsons, 1898a**
PECTORALIS SUPERFICIALIS "deep"		**grand pectoral, sternal posteriuer** O: sternum I: GT to DP crest	**pectoralis, sternum** O: sternum I: DP ridge H		**pectoralis, sternum** O: sternum I: DP ridge H	
PECTORALIS PROFUNDUS	**pectoralis major, costal or deep head** O: ribs 3-9 I: lateral bicipital groove + GT	**petit pectoral** O: ribs 3-9 I: lateral bicipital groove	**pectoralis minor** O: sternum I: near H head	**pectoralis major, posterior sternal 'deep fasiculi'** O: sternum I: GT	**pectoralis minor** O: sternum I: near H head	**pectoralis major, posterior sternal 'deep fasiculi'** O: sternum I: GT
PECTORALIS ABDOMINALIS		**grand pectoral, abdominal** absent	O: sternum + rectus sheath I: DP ridge H	**pectoralis major, posterior sternal** O: sternum + rectus abdominis I: middle H	O: sternum + rectus sheath I: DP ridge H	**pectoralis major, posterior sternal** O: sternum + rectus abdominis I: middle H
SUBCLAVIUS	**subclavius** O: rib 1 I: lateral clavicle	**sous-clavier** O: costal cartilage 1 I: lateral clavicle	**subclavius** O: rib 1 I: lateral clavicle	**subclavius** O: rib 1 I: lateral clavicle	**subclavius** O: rib 1 I: lateral clavicle	**subclavius** O: rib 1 I: lateral clavicle
STERNOSCAPULARIS		**costo-scapulaire** O: w/ subclavius I: acromion		**sterno-clavicularis** O: sternum I: lateral clavicle		
CORACOBRACHIALIS	**coraco-brachialis** O: 2 heads, coracoid process I: distal medial H	**coraco-brachial** O: coracoid process I: medial H	**coracobrachialis superficialis** O: coracoid process I: medial H + epicondyle	**coraco-brachialis** "no trace"	**coracobrachialis superficialis** absent	**coracobrachialis** absent
CORACOBRACHIALIS		**coraco-brachial** O: coracoid process I: distal medial H	**coracobrachialis profundus** O: coracoid process I: near epiphysis H		**coracobrachialis profundus** absent	
BICEPS BRACHII, short head			**biceps brachii** O: coracoid process I: R + U			
BICEPS BRACHII, long head	**biceps** O: glenoid rim I: U near R	**biceps** O: glenoid rim I: medial U + R		**biceps** O: glenoid rim I: U near R	**biceps brachii** O: glenoid tuberosity I: w/ B to U	**biceps** O: glenoid I: U

	Erinaceomorpha					
	Erinaceidae					
	Erinaceus **Dobson, 1882b**	***Erinaceus*** **Julien, 1967**	***Erinaceus*** **Neveu & Gasc, 2002**	***Echinosorex*** **Dobson, 1881**	***Echinosorex*** **Neveu & Gasc, 2002**	***Echinosorex*** **Parsons, 1898a**
BRACHIALIS	**brachialis anticus** O: lateral H I: R	**brachial antérieur** O: lateral DP crest I: w/ BB; then U	**brachialis** O: lateral H I: U	**brachialis anticus** O: lateral H I: R	**brachialis** O: caudal neck H I: w/ BB to U	**brachialis anticus** O: caudal neck H I: w/ BB to U
CUBITALIS						
SUPRASPINATUS	**supraspinatus** O: supraspinous fossa I: GT	**sus-épineux** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT
INFRASPINATUS	**infraspinatus** O: infraspinous fossa I: GT	**sous-épineux** O: infraspinous fossa I: fossa on lateral GT	**infraspinatus** O: infraspinous fossa I: lateral GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT
TRICEPS BRACHII CAPUT LATERALE	**triceps, external** O: lateral H I: lateral olecranon	**triceps vaste externe** O: lateral H + neck I: w/ TLO olecranon	**triceps, caput laterale** O: lateral DP crest I: olecranon	**triceps, external** O: GT + lateral H I: lateral olecranon	**triceps, caput laterale** O: lateral DP crest I: olecranon	**triceps, external** O: GT + lateral H I: lateral olecranon
TRICEPS BRACHII CAPUT MEDIALE	**triceps, posterior** O: caudal H I: lateral olecranon + j capsule	**triceps vaste interne** O: medial to DP crest I: medial olecranon	**triceps, caput mediale** O: caudo-medial H I: olecranon	**triceps, third head** O: caudal H I: cranial olecranon	**triceps, caput mediale** O: caudo-medial H I: olecranon	**triceps, third head** O: caudal H I: cranial olecranon
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps, scapular** O: caudal border scapula I: caudal olecranon	**triceps long chef** O: caudal border scapula I: w/ TLA olecranon	**triceps, caput longum** O: caudal border scapula I: olecranon	**triceps, scapular** O: caudal border scapula I: caudal olecranon	**triceps, caput longum** O: caudal border scapula I: olecranon	**triceps, scapular** O: caudal border scapula I: caudal olecranon
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)						
TRICEPS BRACHII ACCESSORY						
ANCONEUS		**epicondylo-cubital** O: caudal H I: lateral branch bifid olecranon	**anconeus lateralis** O: caudal lateral epicondyle I: lateral olecranon		**anconeus lateralis** O: caudal lateral epicondyle I: lateral olecranon	**anconeus** O: caudal lateral epicondyle I: lateral olecranon
BRACHIORADIALIS	**supinator longus** "absent"	**brachio-radial** absent		**supinator longus** "no trace"		**supinator longus** absent

	Erinaceomorpha					
	Erinaceidae					
	Erinaceus **Dobson, 1882b**	***Erinaceus*** **Julien, 1967**	***Erinaceus*** **Neveu & Gasc, 2002**	***Echinosorex*** **Dobson, 1881**	***Echinosorex*** **Neveu & Gasc, 2002**	***Echinosorex*** **Parsons, 1898a**
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis** O: lateral supracondylar crest I: base MC2 + 3	**extenseur radial du carpe** O: supracondylar crest I: MC2 + 3	**ext carpi radialis longus et brevis** O: lateral supracondylar crest I: base MC2 + 3	**ext carpi radialis** O: lateral epicondyle I: base MC2 + 3	**ext carpi radialis longus et brevis** O: lateral supracondylar crest I: base MC2 + 3	**ext carpi radiales longior et brevior**
EXT CARPI RADIALIS, brevis (MC3)						
EXT DIGITORUM COMMUNIS	**ext digitorum communis** O: lateral epicondyle I: digits 1, 2, 3, 4, 5	**extenseur commun des doigts** O: lateral supracondylar crest w/ EDL I: U?, digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4 / digits 2, 4, 5
EXT DIGITORUM LATERALIS	**ext minimi digiti** O: w/ EDC I: digits 4, 5	**extenseur du V** O: lateral epicondyle I: digits 4, 5	**ext digitorum lateralis** O: lateral epicondyle I: digits 4, 5	**ext minimi digiti** O: w/ EDC I: digits 4, 5	**ext digitorum lateralis** O: lateral epicondyle I: digits 4, 5	**ext minimi digiti** O: lateral epicondyle I: digits 4, 5
EXT CARPI ULNARIS	**ext carpi ulnaris** O: laterl epicondyle + U I: base MC5	**extenseur cubital du carpe** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: laterl epicondyle + U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + olecranon I: base MC5 + sesamoid	**ext carpi ulnaris** I: base MC5
SUPINATOR	**supinator brevis** O: lateral epicondyle I: middle R	**supinateur** O: lateral epicondyle I: cranial R	**supinator** O: lateral epicondylar ridge I: proximal R	**supinator brevis** O: lateral epicondyle I: middle R	**supinator** O: lateral epicondylar ridge 1`	**supinator brevis** "small"
ABD POLLICIS LONGUS	**extensor ossis metacarpi pollicis** O: lateral U I: base MC1	**long abducteur du pouce** O: lateral U I: MC1	**abductor pollicis longus** O: R + U I: base MC1		**abductor pollicis longus** O: U I: base MC1	**ext ossis metacarpi pollicis** O: proximal U
EXT DIGITORUM PROFUNDUS	**ext secundi internodii pollicis et extensor indicis** O: U I: digits 1 + 2	**extenseur profond des doigts** O: lateral U I: digits 1, 2	**ext digitorum profundus** O: U I: digits 1 + 2	**ext secundi internodii pollicis et extensor indicis** O: U + R I: digits 1 + 2	**ext digitorum profundus** O: U I: digits 1 + 2	**ext secundi internodii pollicis** O: middle U I: digit 1
PRONATOR TERES	**pronator radii teres** O: medial epicondyle I: middle R	**rond pronateur** O: medial epicondyle I: cranial R	**pronator teres** O: medial epicondyle I: cranio-medial R	**pronator radii teres** O: medial epicondyle I: distal R	**pronator teres** O: medial epicondyle I: cranio-medial R	**pronator radii teres** I: distal R

	Erinaceomorpha					
	Erinaceidae					
	Erinaceus **Dobson, 1882b**	***Erinaceus*** **Julien, 1967**	***Erinaceus*** **Neveu & Gasc, 2002**	***Echinosorex*** **Dobson, 1881**	***Echinosorex*** **Neveu & Gasc, 2002**	***Echinosorex*** **Parsons, 1898a**
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: base MC2	**fléchisseur radial du carpe** O: medial epicondyle I: base palmar MC2	**flx carpi radialis** O: medial epicondyle I: base MC2	**flx carpi radialis** O: medial epicondyle I: distal R	**flx carpi radialis** O: medial epicondyle I: base MC2	**flx carpi radialis** I: base MC2
PALMARIS LONGUS	**palmaris longus** O: medial epicondyle I: palmar fascia, 1f, 5f	**long palmaire** O: medial epicondyle I: pisiform + palmar aponeurosis	**palmaris longus** O: medial epicondyle I: superficial palmar fascia	**palmaris longus** O: medial epicondyle w/ FDS + FCU I: palmar fascia	**palmaris longus** O: medial epicondyle I: superficial palmar fascia	**palmaris longus** I: palmar fascia
FLX DIGITORUM SUPERFICIALIS	**flx digitorum sublmis (perforatus)** O: medial epicondyle I: digits 2, 3, 4	**fléchisseur superficiel des doigts** O: medial epicondyle I: digits 2, 3, 4 = p	**flexor digitorum superficialis** O: medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum sublmis (perforatus)** O: medial epicondyle I: digits 2, 3, 4	**flexor digitorum superficialis** O: medial epicondyle I: digits 2, 3, 4, 5	**flx sublimis digitorum** O: medial epicondyle I: digits 2, 3, 4
INTERFLEXORII						
FLX DIGITORUM PROFUNDUS,	**flx digitorum profundus (perforans)**	**fléchisseur profond des doigts**	**flx digitorum profundus**	**flx digitorum profundus (perforans)**	**flx digitorum profundus**	**flx digitorum profundus**
epicondylar	O: medial epicondyle		O: medial epicondyle	O: medial epicondyle		O: medial epicondyle
epicondylar (FDPe)	O: medial epicondyle		O: medial epicondyle	O: medial epicondyle		O: medial epicondyle
epicondylar (FDPd)	O: medial epicondyle		O: medial epicondyle	O: medial epicondyle		O: medial epicondyle
ulnar	O: U	O: U	O: U	O: U	O: U	O: U
radial	O: R		O: R	O: R	O: R	O: R
	*I: digits 1, 2, 3, 4, 5	*I: digits 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5
LUMBRICALES	**lumbricales** O: FDP I: none, or digit 3	**lombricaux** O: FDP I: digits 3, 4, 5	**lumbricales manus** absent	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales manus** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5
FLX CARPI ULNARIS,	**flx carpi ulnaris**	**fléchisseur cubital du carpe**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**
epitrochlear belly	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle
ulnar belly	O: medial olecranon I: pisiform	O: medial olecranon I: pisiform	O: medial olecranon I: pisiform	O: medial olecranon I: pisiform + callosity of manus	O: medial olecranon I: pisiform	O: medial olecranon I: pisiform

	Erinaceomorpha					
	Erinaceidae					
	Erinaceus **Dobson, 1882b**	***Erinaceus*** **Julien, 1967**	***Erinaceus*** **Neveu & Gasc, 2002**	***Echinosorex*** **Dobson, 1881**	***Echinosorex*** **Neveu & Gasc, 2002**	***Echinosorex*** **Parsons, 1898a**
EPITROCHLEO-ANCONEUS		**épitrochléo-olécrânien** O: medial epicondyle I: medial olecranon	**anconeus medialis** O: caudal medial epicondyle I: medial olecranon		**anconeus medialis** O: caudal medial epicondyle I: medial olecranon	**epitrochleo-anconeus** O: caudal medial epicondyle I: medial olecranon
PRONATOR QUADRATUS		**carré pronateur** O: U + R	**pronator quadratus** O: interosseus space		**pronator quadratus** O: interosseus space	
PALMARIS BREVIS		**court palmaire** absent		**palmaris brevis** O: pisiform I: palmar fascia		
FLX DIGITORUM BREVES MANUS	**palmaris brevis** O: palmaris longus I: digit 1f, 5f, palmar callosity	**court fléchisseur des doigts de la main** O: PL I: dig 5f	**flexor digitorum brevis manus** O: palmar aponeurosis I: digit 5			
ABD DIGITI MINIMI	**abductor minimi digiti** O: pisiform I: digit 5	**abducteur du V** O: pisiform I: digit 5	**abd minimi digiti** O: pisiform + annular ligament I: digit 5	**abductor minimi digiti** O: pisiform I: digit 5	**abd minimi digiti** O: pisiform I: digit 5	**abd minimi digiti** O: pisiform
ABD POLLICIS BREVIS	**abductor pollicis** O: annular ligament I: digit 1	**abducteur du I** O: trapezium I: digit 1	**abd pollicis brevis** O: trapezium I: digit 1	**abductor pollicis** O: trapezium I: radial sesamoid	**abd pollicis brevis** O: trapezium I: digit 1	**abd pollicis** "no thenar muscles are specialized"
CONTRAHENTES	**adductor pollicis, indicis, etc** absent	**contracteurs des doigts** absent		**dorsal interossei** absent		**adductors** absent
FLEXOR BREVES PROFUNDUS	**flexores breves vel interossei** 10	**muscles interosseux** 10 fibrous sheet	**interossei palmares** 10	**flexores breves vel interossei** 10	**interossei palmares** 10	**flx brevis** 10
INTERMETACARPALES	**abductor indicis**					**interossei** absent
? Unknown homology						
RADIAL SESAMOID "PRE-POLLUX"						
ULNAR SESAMOID						
CARPAL VIBRISSAE						

	Soricomorpha					
	Soricidae					
	Crocidura **Haines, 1955**	***Crocidura*** **Julien, 1967**	***Crocidura*** **Neveu & Gasc, 2002**	***Suncus*** **Sharma, 1958**	***Cryptotis*** **Gugler, 1959**	***Sorex*** **Reed, 1951**
PANNICULUS CARNOSUS				**panniculus carnosus - cutaneus maximus + spino-cuticularis** O: entire body I: H between pectoral process + LT, spine scapula		**cutaneus maximus** I: pectoral process near LT
STERNO-FACIALIS						
STERNOMASTOIDEUS		**sterno-mastoïdien** O: ? I: midline raphe + sternum	**sterno-mastoideus** O: mastoid w/CM I: distal sternum	**sternomastoideus** O: "tabular" w/ CM I: manubrium + midline raphe	**sternomastoideus** O: "tabular" I: manubrium + ventral raphe	
CLEIDOMASTOIDEUS		**cléido-mastoïdien** O: ? I: clavicle	**cleido-mastoideus** O: mastoid w/SM I: clavicle proximal to CT	**cleidomastoideus** O: medial clavicle I: "tabular" w/ SM	**cleidomastoideus** O: "tabular" I: lateral clavicle	
CLAVOTRAPEZIUS		**cléido-occipital** O: ? I: clavicle	**cleido-occipitalis** O: occipital crest I: clavicle distal to CM	**cleido-occipitalis** O: supraoccipital I: medial clavicle	**cleido-occipitalis** O: occiput I: medial clavicle	
CEPHALOHUMERALIS						
ACROMIOTRAPEZIUS		**trapèze antérieur** O: occipital crest, ligamentum nuchae, T1 I: tip metacromion	**trapezius anterior** O: occipital crest, ligamentum nuchae, T1 I: metacromion	**trapezius anticus pars capitis, cervicis** O: lambdoidal crest / ligamentum nuchae I: metacromion / metacromion * 2 parts	**trapezius anticus pars capitis, cervicis** O: lambdoidal crest / ligamentum nuchae I: metacromion / metacromion * 2 parts	**trapezius anticus** O: parietal-occipital suture, ligamentum nuchae I: metacromion * 2 parts
DORSO-CUTANEUS				**dorso-cuticularis** O: lumbodorsal fascia I: skin behind ear		
SPINOTRAPEZIUS		**trapèze postérieur** O: L1 I: posterior scap spine	**trapezius posterior** O: last 2 T vert I: distal 1/3 scap spine	**trapezius posticus** O: last 2 T vert - L1 I: spine scapula	**trapezius posticus** O: first L vertebrae I: tuber spinae	**trapezius posticus** O: 3-4L + lumbodorsal fascia I: tuber spinae

	Soricomorpha					
	Soricidae					
	Crocidura Haines, 1955	*Crocidura* Julien, 1967	*Crocidura* Neveu & Gasc, 2002	*Suncus* Sharma, 1958	*Cryptotis* Gugler, 1959	*Sorex* Reed, 1951
RHOMBOIDEUS CAPITIS		**r. occipital** O: w/ RC occipital crest + ligamentum nuchae I: w/ RC middle vertebral border	**r. capitis et cervicis** O: occipital crest, ligamentum nuchae 1T vert I: vertebral border scapula	**r. capitis** O: lamboidal ridge I: vertebral border scapula	**r. capitis** O: lambdoidal crest I: vertebral border scapula	**r. capitis** O: parietal-occipital suture I: vertebral border scapula
RHOMBOIDEUS CERVICIS		**r. cervical** O: w/ RO occipital crest + ligamentum nuchae I: w/ RO middle vertebral border		**r. cervicis** O: ligamentum nuchae I: vertebral border scapula	**r. cervicis** O: ligamentum nuchae I: vertebral border scapula	**r. cervicis** O: ligamentum nuchae I: vertebral border scapula
RHOMBOIDEUS THORACIS		**r. dorsal**	**r. dorsi** O: 2-3T verts I: vertebral border scapula	**r. posticus** O: T1-2 I: caudal angle scapula	**r. posticus** "not included in study"	**r. posticus** O: ligamentum nuchae + opposite partner I: near caudal angle scapula
OMOTRANSVERSARIUS		**acromio-trachélien** O: atlas I: metacromion	**omotransversarius** O: atlas I: metacromion	**atlantoscapularis anterior** O: atlas I: metacromion	**atlanto-scapularis anterior** O: atlas I: metacromion	**atlantoscapularis posterior** O: atlas I: metacromion
OMOTRANSVERSARIUS				**atlantoscapularis posterior** absent	**atlanto-scapularis posterior** O: atlas I: vertebral border scapula	**atlantoscapularis anterior** absent
OMOHYOIDEUS					**omohyoideus** O: hyoid I: cranial border neck scapula	
SERRATUS VENTRALIS CERVICIS		**elévator de l'omoplate** O: I: w/ SVT on deep surface near cranial angle	**serratus ventralis cervicis** O: C1-7 I: deep surface vertebral border scapula	**serratus anterior cervicis** O: C4-7 I: deep surface caudal angle scapula	**serratus anterior cervicis** O: C vertebrae I: deep surface vertebral border scapula	**serratus anterior cervicis** O: C2-7 I: deep surface vertebral border scapula
SERRATUS VENTRALIS THORACIS		**grand dentelé** O: ribs via 6 digitations I: w/ SVC on deep surface near cranial angle	**serratus ventralis thoracis** O: ribs I: deep surface vertebral border scapula	**serratus anterior thoracis** O: ribs 1-8 I: deep surface caudal angle scapula	**serratus anterior thoracis** O: proximal ribs I: deep surface vertebral border scapula	**serratus anterior thoracis** O: ribs 1-5 I: deep surface caudal angle scapula
CLAVODELTOIDEUS		**cléido-deltoïde** O: clavicle I: distal DP crest	**deltoideus pars clavicularis** O: lateral clavicle I: DP crest	**cleidodeltoideus** O: lateral clavicle I: lateral pectoral ridge	**cleidodeltoideus** O: lateral clavicle I: distal pectoral ridge H	**cleidodeltoideus** O: lateral clavicle I: distal pectoral ridge

	Soricomorpha					
	Soricidae					
	Crocidura **Haines, 1955**	***Crocidura*** **Julien, 1967**	***Crocidura*** **Neveu & Gasc, 2002**	***Suncus*** **Sharma, 1958**	***Cryptotis*** **Gugler, 1959**	***Sorex*** **Reed, 1951**
ACROMIODELTOIDEUS		**acromio-deltoïde** O: acromion I: DP crest	**deltoideus pars acromialis** O: acromion I: DP crest	**acromiodeltoideus** O: acromion + acromioclavicular joint I: pectoral process H	**acromiodeltoideus** O: acromion + acromioclavicular joint + clavicle I: distal deltoid ridge H	**acromiodeltoideus** O: acromion + acromioclavicular joint I: w/ CD lateral pectoral process
SPINODELTOIDEUS		**spino-deltoïde** O: spine scapula I: lateral DP crest	**deltoideus pars spinalis** O: spine scapula I: DP crest	**spinodeltoideus** O: spine scapula I: deltoid ridge H	**spinodeltoideus** O: spine scapula I: deltoid ridge H	**spinodeltoideus** O: spine scapula I: lateral deltoid ridge
TERES MINOR		**petit rond** O: w/ IN neck scapula I: w/ IN lateral GT	**teres minor** absent	**teres minor** absent		**teres minor** absent
SUBSCAPULARIS		**sous-scapulaire** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis (2)** O: subscapular fossa + caudal border scapula I: LT + LT
TERES MAJOR		**grand rond** I: teres tuber	**teres major** O: caudal border scapula I: medial H	**teres major** O: caudal border scapula I: teres tubercle	**teres major** O: caudal angle scapula I: teres tubercle	**teres major** O: caudal angle scapula I: teres tubercle
LATISSIMUS DORSI		**grand dorsal** O: L verts + last ribs I: medial H	**latissimus dorsi** O: thoracolumbar fascia + ribs I: proximal medial H	**latissimus dorsi** O: thoracolumbar fascia + ribs 8-12, T8-L3 I: teres tubercle	**latissimus dorsi** O: proximal L vertebrae, distal ribs I: teres tubercle	**latissimus dorsi** O: last T, first L vertebrae, lumbodorsal fascia I: teres tubercle
DORSO-EPITROCHLEARIS		**dorso-épitrochléo-olécrânien** O: LD I: medial olecranon	**dorso-epitrochlearis** O: LD I: medial olecranon	**dorso-epitrochlearis** O: LD I: fascia proximal forearm	**dorso-epitrochlearis** O: LD I: medial fascia elbow	**dorso-epitrochlearis** O: LD I: medial elbow fascia
PECTORALIS SUPERFICIALIS "clavicular"						
PECTORALIS SUPERFICIALIS "superficial"		**grand pectoral, sternal anterieure** O: manubrium I: DP crest	**pectoralis, clavicular** O: sternum I: DP ridge H	**pectoralis superficialis anticus** O: sternum I: distal pectoral ridge	**pectoralis superficialis anticus** O: manubrium + ventral raphe I: pectoral ridge H	**pectoralis superficialis anticus** O: sternum + ventral raphe I: distal pectoral ridge

	Soricomorpha					
	Soricidae					
	Crocidura **Haines, 1955**	***Crocidura*** **Julien, 1967**	***Crocidura*** **Neveu & Gasc, 2002**	***Suncus*** **Sharma, 1958**	***Cryptotis*** **Gugler, 1959**	***Sorex*** **Reed, 1951**
PECTORALIS SUPERFICIALIS "deep"		**grand pectoral, sternal posteriuer** O: manubrium + sternum I: DP crest	**pectoralis, sternum** O: sternum I: DP ridge H	**pectoralis superficialis posticus** O: sternum I: distal pectoral ridge	**pectoralis superficialis posticus** O: sternum I: pectoral ridge H	**pectoralis superficialis posticus** O: sternum
PECTORALIS PROFUNDUS		**petit pectoral** O: sternum + xiphiphoid I: DP crest	**pectoralis minor** O: sternum I: near H head	**pectoralis profundus** O: sternum I: pectoral ridge	**pectoralis profundus** O: sternum I: pectoral ridge H	**pectoralis profundus** O: sternum I: pectoral process
PECTORALIS ABDOMINALIS		**grand pectoral, abdominal** absent	O: sternum + rectus sheath I: DP ridge H	**pectoralis abdominalis** absent		**pectoralis abdominalis** absent
SUBCLAVIUS		**sous-clavier** O: costal cartilage 1 I: lateral clavicle	**subclavius** O: rib 1 I: lateral clavicle	**subclavius** O: rib 1 I: lateral clavicle	**subclavius** O: rib 1 I: lateral clavicle	**subclavius** O: rib 1 I: clavicle
STERNOSCAPULARIS		**costo-scapulaire** - -		**costoscapularis** absent		**costoscapularis ventralis** absent
CORACOBRACHIALIS		**coraco-brachial** - -	**coracobrachialis superficialis** O: coracoid process I: medial H + epicondyle	**coraco-brachialis** absent	**coracobrachialis** absent	**coracobrachialis** absent
CORACOBRACHIALIS		- -	**coracobrachialis profundus** absent			
BICEPS BRACHII, short head						
BICEPS BRACHII, long head		**biceps** O: glenoid rim I: medial U + R	**biceps brachii** O: coracoid process I: R + U	**biceps brachii** O: glenoid rim I: R + U	**biceps brachii** O: glenoid I: w/ B medial U + R	**biceps brachii** O: rim glenoid I: w/ B U + R

	Soricomorpha					
	Soricidae					
	Crocidura **Haines, 1955**	***Crocidura*** **Julien, 1967**	***Crocidura*** **Neveu & Gasc, 2002**	***Suncus*** **Sharma, 1958**	***Cryptotis*** **Gugler, 1959**	***Sorex*** **Reed, 1951**
BRACHIALIS		**brachial antérieur** O: 2 heads I: ?U	**brachialis** O: lateral H I: U	**brachialis** O: proximal caudal H I: R + U	**brachialis**	**brachialis** O: caudal LT - GT I: w/ BB U + R
CUBITALIS						
SUPRASPINATUS		**sus-épineux** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT
INFRASPINATUS		**sous-épineux** O: infraspinous fossa I: fossa on lateral GT	**infraspinatus** O: infraspinous fossa I: lateral GT	**infraspinatus** O: infraspinous fossa I: distal GT	**infraspinatus** O: infraspinous fossa I: distal GT	**infraspinatus** O: infraspinous fossa I: distal GT
TRICEPS BRACHII CAPUT LATERALE		**triceps vaste externe**	**triceps, caput laterale** O: lateral DP crest I: olecranon	**triceps brachii, lateral head** O: lateral H distal to GT I: olecranon	**triceps brachii, lateralis** O: lateral H I: lateral olecranon	**triceps, lateral** O: lateral H I: lateral olecranon
TRICEPS BRACHII CAPUT MEDIALE		**triceps vaste interne**	**triceps, caput mediale** O: caudo-medial H I: olecranon	**triceps brachii, superficial part of medial head** O: teres tubercle I: medial olecranon	**triceps brachii, medialis (2 heads)** O: teres tubercle + caudal H I: medial olecranon + cranial olecranon	**triceps, medial** O: teres tubercle + medial H I: medial olecranon
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)		**triceps long chef** O: caudal border scapula I: w/ TLA olecranon	**triceps, caput longum** O: caudal border scapula I: olecranon	**triceps brachii, long head** O: caudal border scapula I: olecranon	**triceps brachii, longus (2 parts)** O: caudal border scapula I: olecranon	**triceps, long** O: caudal border scapula I: olecranon
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)		**triceps long chef** O: caudal border scapula I: w/ TLA olecranon		**triceps brachii, long head** O: tubercle on caudal border scapula I: olecranon		
TRICEPS BRACHII ACCESSORY				**triceps brachii, deep part of medial head** O: distal caudal H I: olecranon		**triceps, deep medial** O: distal caudal H I: olecranon
ANCONEUS		**epicondylo-cubital** "rudimentary"	**anconeus lateralis** O: caudal lateral epicondyle I: lateral olecranon	**anconeus lateralis** O: lateral epicondyle I: lateral U	**anconeus lateralis** O: lateral epicondyle I: lateral U	**anconeus lateralis** O: lateral epicondyle I: lateral olecranon
BRACHIORADIALIS		**brachio-radial** absent		**brachio-radialis** absent		**brachioradialis** absent

	Soricomorpha					
	Soricidae					
	Crocidura **Haines, 1955**	*Crocidura* **Julien, 1967**	*Crocidura* **Neveu & Gasc, 2002**	*Suncus* **Sharma, 1958**	*Cryptotis* **Gugler, 1959**	*Sorex* **Reed, 1951**
EXT CARPI RADIALIS, longus (MC2)		**extenseur radial du carpe** O: supracondylar crest I: MC2 + 3	**ext carpi radialis longus et brevis** O: lateral supracondylar crest I: base MC2 + 3	**ext carpi radialis** O: lateral epicondyle I: MC2 + 3	**ext carpi radialis** O: lateral epicondyle I: MC2 + 3 + between MC2 + 3	**ext carpi radialis** O: lateral epicondyle I: between MC2 + 3, MC3
EXT CARPI RADIALIS, brevis (MC3)						
EXT DIGITORUM COMMUNIS		**extenseur commun des doigts** O: lateral supracondylar crest w/ EDL I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: MC1, digits 2, 3, 3, 3, 4, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digit 2, 3, 3, 4, 5
EXT DIGITORUM LATERALIS		**extenseur du V** O: lateral epicondyle I: digits 4, 5	**ext digitorum lateralis** O: lateral epicondyle I: digits 4, 5	**ext digiti quinti proprius** O: lateral epicondyle I: digits 4, 5	**ext digiti quinti proprius** O: lateral epicondyle I: digits 4, 5	**ext digiti quinti proprius** O: lateral epicondyle I: digits 4, 5
EXT CARPI ULNARIS		**extenseur cubital du carpe** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: MC5
SUPINATOR		**supinateur** O: lateral epicondyle I: cranial R	**supinator** O: lateral epicondylar ridge I: proximal R	**supinator** O: lateral epicondyle I: proximal cranial R	**supinator** O: lateral epicondyle I: proximal cranial R	**supinator** O: lateral epicondyle I: proximal cranial R
ABD POLLICIS LONGUS		**long abducteur du pouce**	**abd pollicis longus** O: R + U I: base MC1	**abd pollicis longus**	**abd pollicis longus** O: lateral olecranon I: base MC1	**abd pollicis longus** O: lateral olecranon I: base MC1
EXT DIGITORUM PROFUNDUS	**ext pollicis longus** I: MC1	**extenseur profond des doigts** O: lateral olecranon I: digits 1, 2, 3	**ext digitorum profundus** O: U I: digits 1 + 2	**ext indicis et pollicis longus** O: lateral olecranon I: digits 1, 2, 3	**ext indicis et pollicis longus** O: lateral olecranon I: digits 1, 2, w/ EDC3	**ext indicis et pollicis longus** O: lateral olecranon I: digits 1, 2, 3
PRONATOR TERES		**rond pronateur** O: medial epicondyle I: cranial R	**pronator teres** O: medial epicondyle I: cranio-medial R	**pronator radii teres** O: medial epicondyle I: middle R	**pronator radii teres** O: medial epicondyle I: middle R	**pronator radii teres** O: medial epicondyle I: middle cranial R

	Soricomorpha					
	Soricidae					
	Crocidura **Haines, 1955**	***Crocidura*** **Julien, 1967**	***Crocidura*** **Neveu & Gasc, 2002**	***Suncus*** **Sharma, 1958**	***Cryptotis*** **Gugler, 1959**	***Sorex*** **Reed, 1951**
FLX CARPI RADIALIS		**fléchisseur radial du carpe** O: medial epicondyle I: base palmar MC3	**flx carpi radialis** O: medial epicondyle I: base MC3	**flx carpi radialis** O: medial epicondyle I: base MC3	**flx carpi radialis** O: medial epicondyle I: base MC3	**flx carpi radialis** O: medial epicondyle I: base palmar MC3 (sesamoid)
PALMARIS LONGUS		**long palmaire** O: medial epicondyle I: tendons to MC2, 3, 4, 5	**palmaris longus** O: medial epicondyle I: superficial palmar fascia	**palmaris longus** O: medial epicondyle w/ FCU I: palm fascia **medial tendon contains sesamoid	**palmaris longus** O: medial epicondyle I: superficial palmar fascia	**palmaris longus** O: tip medial epicondyle I: 2 carpal pads
FLX DIGITORUM SUPERFICIALIS	**flx digitorum sublimis** * FDS + FBM do not form sheath for FDP I: digits 2, 3, 4	**fléchisseur superficiel des doigts** O: medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum superficialis** O: medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum sublimis** O: medial epicondyle (3 heads) I: digits 2f, 3f, 4f	**flx digitorum sublimis** O: medial epicondyle (3 heads) I: digits 2f, 3f, 4f	**flx digitorum sublimis** O: medial epicondyle (3 heads) I: digits 2f, 3f, 4f
INTERFLEXORII						
FLX DIGITORUM PROFUNDUS,		**fléchisseur profond des doigts**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**
epicondylar		O: medial epicondyle		O: medial epicondyle	O: distal medial epicondyle	O: medial epicondyle
epicondylar (FDPe)				O: medial epicondyle	O: distal medial epicondyle	O: medial epicondyle
epicondylar (FDPd)				O: distal medial epicondyle	O: distal medial epicondyle	O: caudal medial epicondyle
ulnar		O: U	O: U	O: medial olecranon	O: medial olecranon	O: medial olecranon
radial			O: R	O: proximal R	O: proximal R	O: R
		*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5
LUMBRICALES	**lumbricals** absent	**lombricaux** - -	**lumbricales manus** absent		**lumbricals** absent	
FLX CARPI ULNARIS,		**fléchisseur cubital du carpe**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**
epitrochlear belly		O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	-	-
ulnar belly		O: medial olecranon I: pisiform	O: medial olecranon I: pisiform	O: medial olecranon I: pisiform	O: medial olecranon I: pisiform	O: olecranon I: pisiform

	Soricomorpha					
	Soricidae					
	Crocidura **Haines, 1955**	***Crocidura*** **Julien, 1967**	***Crocidura*** **Neveu & Gasc, 2002**	***Suncus*** **Sharma, 1958**	***Cryptotis*** **Gugler, 1959**	***Sorex*** **Reed, 1951**
EPITROCHLEO-ANCONEUS		**épitrochléo-olécrânien** O: medial epicondyle I: medial olecranon	**anconeus medialis** O: caudal medial epicondyle I: medial olecranon	**epitrochleo-anconeus** O: medial epicondyle I: olecranon	**epitrochleo-anconeus** O: medial epicondyle I: olecranon	**epitrochleo-anconeus** O: medial epicondyle I: olecranon
PRONATOR QUADRATUS		**carré pronateur** O: R + U	**pronator quadratus** O: interosseus space	**pronator quadratus** O: proximal cranial R + medial U	**pronator quadratus** O: R + U	**pronator quadratus** O: R + U
PALMARIS BREVIS		**court palmaire** absent				
FLX DIGITORUM BREVES MANUS	**flx brevis digitorum manus** I: dig 5	**court fléchisseur des doigts de la main** O: PL I: dig 5f	**flx digitorum brevis manus** O: palmar aponeurosis I: digit 5	**flx brevis digitorum manus** O: pisiform + PL tendon I: digit 5f		**palmaris longus** O: PL I: digit 5f
ABD DIGITI MINIMI	**abd digiti V** "well developped"	**abducteur du V** O: pisiform I: digit 5	**abd minimi digiti** O: pisiform + annular ligament I: digit 5	**abd digiti quinti** O: pisiform + PL tendon I: sesamoids MC5	**abd digiti quinti** O: pisiform + sesamoid I: MC5	
ABD POLLICIS BREVIS	**abd pollicis brevis** "well developped"	**abducteur du I** O: trapezium I: digit 1	**abd pollicis brevis** O: trapezium I: digit 1	**abd pollicis brevis** O: scapholunar I: medial sesamoid MC1	**abd pollicis brevis** O: sesamoid near scaphoid I: MC1	
CONTRAHENTES	**contrahentes** absent	**contracteurs des doigts** absent			**contrahentes** absent	
FLEXOR BREVES PROFUNDUS	**flx breves profundi** 10 fibrous sheet	**muscles interosseux** 9 fibrous sheet	**interossei palmares** 10	**flx breves** 10	**flx breves** 10	**flexores breves** 10
INTERMETACARPALES					**dorsal interossei** absent	**interossei dorsales** absent
? Unknown homology						**costoscapularis dosralis** absent
RADIAL SESAMOID "PRE-POLLUX"				present - in PL tendon		
ULNAR SESAMOID						
CARPAL VIBRISSAE	present					

	Soricomorpha continued					
	Solenodontidae		Talpidae			
	Solenodon **Allen, 1910**	***Solenodon*** **Dobson, 1882b**	***Desmana*** **Dobson, 1883**	***Desmana*** **Whidden, 2000**	***Galemys*** **Whidden, 2000**	***Neurotrichus*** **Reed, 1951**
PANNICULUS CARNOSUS	**panniculus carnosus** "extraordinarily developed" I: vertebral border scapula, spine scapula, w/ PS, cranio-medial H	**humero-dorsales and humero-abdominales** O: back + sides I: deep pectorals		**cutaneus maximus** O: dorsum I: lateral pectoral process near PA + PSd	**cutaneus maximus** O: dorsum I: lateral pectoral process near PA + PSd	**cutaneus maximus** I: pectoral process near LT
STERNO-FACIALIS	**sterno-facialis** O: skin of face I: fascia over PS			**sterno-occipitalis** O: lateral skull w/ CT I: manubrium	**sterno-occipitalis**	
STERNOMASTOIDEUS	**sterno-mastoideus** O: occiput w/ CM I: manubrium deep to PS	**sterno-mastoid** O: mastoid process I: sternum	**sterno-mastoid** O: w/ CM mastoid process I: sternum	**sternomastoideus** absent	**sternomastoideus** ?	
CLEIDOMASTOIDEUS	**cleido-mastoideus** O: occiput w/ SM I: lateral clavicle	**cleido-mastoid** O: mastoid process I: middle clavicle	**cleido-mastoid** O: w/ SM mastoid process I: clavicle	**cleidomastoideus** O: base zygomatic arch w/ SM I: medial clavicle	**cleidomastoideus** ?	
CLAVOTRAPEZIUS	**clavo-trapezius** O: occiput w/ AT	**cleido-occipital** I: clavicle	**cleido-occipital** O: behind EAM I: lateral clavicle	**cleido-occipitalis** O: lateral skull w/ SMs I: medial clavicle	**cleido-occipitalis** ?	
CEPHALOHUMERALIS						
ACROMIOTRAPEZIUS	**acromio-trapezius** O: occiput - I: spine scapula	**trapezius** O: occipital crest, ligamentum nuchae, T1-2 I: acromion + scapular spine	**trapezius anticus** O: occiput and ligamentum nuchae I: metacromion + spine scapula	**trapezius anticus, pars capitis + pars cervicis** O: occiput / ligamentum nuchae I: metacromion / metacromion bifid	**trapezius anticus, pars capitis + pars cervicis** O: occiput / ligamentum nuchae I: metacromion / metacromion bifid	**trapezius anticus** O: occiput, ligamentum nuchae I: metacromion
DORSO-CUTANEUS	**dorso-cuticularis** O: rib 14 / T14 I: ?PC over scapula		**dorso-cuticulares** O: ilium I: skin neck + head	**dorsocuticularis** O: iliac crest I: skin of back	**dorsocuticularis** O: iliac crest I: skin of back	
SPINOTRAPEZIUS	**spino-trapezius** O: - mid T verts I: spine scapula	**posterior trapezius** O: last 6T I: posterior scapular spine	**trapezius posticus** O: ilium + lumbar fascia I: prominence spine of scapula	**trapezius posticus** O: lumbar vertebrae + iliac crest I: tuber spinae	**trapezius posticus** O: lumbar vertebrae + iliac crest I: tuber spinae	**trapezius posticus** O: 3-6L + lumbodorsal fascia I: tuber spinae

	Soricomorpha continued					
	Solenodontidae		Talpidae			
	Solenodon **Allen, 1910**	***Solenodon*** **Dobson, 1882b**	***Desmana*** **Dobson, 1883**	***Desmana*** **Whidden, 2000**	***Galemys*** **Whidden, 2000**	***Neurotrichus*** **Reed, 1951**
RHOMBOIDEUS CAPITIS	**occipito-scapularis** O: occiput I: vertebral border scapula near cranial angle		**r. anticus, occipital** O: superoccipital I: vertebral border scapula	**r. capitis** O: occiput I: vertebral border scapula	**r. capitis**	**r. capitis** O: parietal-occipital suture I: vertebral border scapula
RHOMBOIDEUS CERVICIS	**r. anticus** O: occiput + C verts I: vertebral border scapula	**rhomboideus** O: occiput, C verts, T1-3	**r. anticus, cervical** O: C verts I: vertebral border scapula	**r. cervicis** O: ligamentum nuchae I: vertebral border scapula	**r. cervicis**	**r. cervicis** O: ligamentum nuchae I: vertebral border scapula
RHOMBOIDEUS THORACIS	**r. posticus** O: C6-T5 I: vertebral border scapula	**r. posticus** O: T4-6	**r. posticus** O: opposite partner I: rib 3, caudal angle of scapula	**r. posticus** O: dorsal raphe I: vertebral border scapula	**r. posticus** O: dorsal raphe I: vertebral border scapula	**r. posticus** O: opposite partner I: vertebral border scapula
OMOTRANSVERSARIUS	**levator claviculae** O: atlas I: metacromion	**levator scapulae** O: atlas I: tip acromion	**occipito-scapularis externus** O: superoccipital I: w/ AT metacromion	**atlantoscapularis anterior** O: atlas I: metacromion	**atlantoscapularis anterior** O: atlas I: metacromion	**atlantoscapularis anterior** absent
OMOTRANSVERSARIUS			**levator scapulae vel claviculae** O: atlas I: metacromion	**atlantoscapularis posterior** absent	**atlantoscapularis posterior** absent	**atlantoscapularis posterior** absent
OMOHYOIDEUS		**omo-hyoid** "no trace"	**omo-hyoid**	**omohyoideus** absent	**omohyoideus** absent	
SERRATUS VENTRALIS CERVICIS	**levator anguli scapulae** O: C5-7 I: deep surface cranial angle scapula		**levator angulae scapulae** O: C verts I: vertebral border scapula	**serratus ventralis cervicis**	**serratus ventralis cervicis** O: C3-7, rib 1 I: deep surface vertebral border scapula	**serratus anterior cervicis** O: C3-7 I: deep surface caudal angle scapula
SERRATUS VENTRALIS THORACIS	**serratus magnus** O: ribs 1-9 I: deep surface caudal angle scapula		**serratus magnus** O: ribs 2-9 I: vertebral border scapula	**serratus ventralis thoracis** O: ribs 3-10 I: deep surface vertebral border scapula	**serratus ventralis thoracis** O: ribs 3-10 I: deep surface vertebral border scapula	**serratus anterior thoracis** O: ribs 3-9 I: deep surface vertebral border scapula
CLAVODELTOIDEUS				**cleidodeltoideus** O: w/ AD lateral clavicle I: w/ AD deltoid fossa H	**cleidodeltoideus** O: w/ AD lateral clavicle I: w/ AD deltoid fossa H	**cleidodeltoideus** O: lateral clavicle I: proximal pectoral ridge

	Soricomorpha continued					
	Solenodontidae		Talpidae			
	Solenodon **Allen, 1910**	***Solenodon*** **Dobson, 1882b**	***Desmana*** **Dobson, 1883**	***Desmana*** **Whidden, 2000**	***Galemys*** **Whidden, 2000**	***Neurotrichus*** **Reed, 1951**
ACROMIODELTOIDEUS	**acromio-deltoideus** O: acromion I: DP crest w/ SD	**deltoid** O: acromion I: cranial H		**acromiodeltoideus** O: w/ CD lateral clavicle I: w/ CD deltoid fossa H	**acromiodeltoideus** O: w/ CD lateral clavicle I: w/ CD deltoid fossa H	**acromiodeltoideus** O: lateral clavicle I: distal pectoral ridge
SPINODELTOIDEUS	**spino-deltoideus** O: scapula I: DP crest w/ AD	**deltoid** O: spine scapula I: cranial H		**spinodeltoideus** O: tuber spinae + spine scapula I: deltoid process H	**spinodeltoideus** O: tuber spinae + spine scapula I: deltoid process H	**spinodeltoideus** O: tuber spinae + spine scapula I: deltoid ridge
TERES MINOR	**micostalis** O: caudal border scapula I: distal GT	**teres minor** O: w/ IN I: w/ IN	**teres minor** O: caudal border scapula I: GT			**teres minor** absent
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT		**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa + caudal border scapula (2 heads) I: LT	**subscapularis** O: subscapular fossa + caudal border scapula (2 heads) I: LT	**subscapularis (2)** O: subscapular fossa I: LT
TERES MAJOR		**teres major**	**teres major** O: supra-scapular border I: w/ LD bicipital groove	**teres major** O: vertebral border scapula I: teres tubercle H	**teres major** O: vertebral border scapula I: teres tubercle H	**teres major** O: caudal angle scapula I: w/ TMA teres tubercle
LATISSIMUS DORSI	**latissimus dorsi** O: rib 9-12, T9-12 I: cranio-medial H	**latissimus dorsi**	**latissimus dorsi** O: L1-3, ilium I: w/ TMA bicipital groove	**latissimus dorsi** O: last T vertebrae, fascia lumbar region, iliac crest I: TMA	**latissimus dorsi** O: last T vertebrae, fascia lumbar region, iliac crest I: TMA	**latissimus dorsi** I: last T, all L vertebrae I: w/ TMA teres tubercle
DORSO-EPITROCHLEARIS	**epitrochlearis** O: LD + TMA I: olecranon	**dorso-epitrochlearis** O: LD + TMA I: caudal edge olecranon	**dorso-epitrochlearis** O: LD I: medial olecranon	**dorsoepitrochlearis** O: LD I: fascia forearm flexors	**dorsoepitrochlearis** O: LD I: fascia forearm flexors	**dorso-epitrochlearis** O: LD I: medial elbow fascia
PECTORALIS SUPERFICIALIS "clavicular"	**ectopectoralis, clavicular portion** O: clavicle I: middle cranial H		**pectoralis major, clavicular** O: lateral clavicle I: DP ridge + LT			
PECTORALIS SUPERFICIALIS "superficial"	**ectopectoralis, sternal portion** O: manubrium + sternum I: middle cranial H	**pectoralis major, anterior sternal** O: sternum + ventral raphe I: w/ PSc distal half H	**pectoralis major, anterior** O: sternum I: DP ridge + LT	**pectoralis superficialis pars anticus** O: manubrium + ventral raphe I: medial pectoral process H	**pectoralis superficialis pars anticus** O: manubrium + ventral raphe I: medial pectoral process H	**pectoralis superficialis anticus** O: manubrium + ventral raphe I: pectoral process H

	Soricomorpha continued					
	Solenodontidae		Talpidae			
	Solenodon **Allen, 1910**	***Solenodon*** **Dobson, 1882b**	***Desmana*** **Dobson, 1883**	***Desmana*** **Whidden, 2000**	***Galemys*** **Whidden, 2000**	***Neurotrichus*** **Reed, 1951**
PECTORALIS SUPERFICIALIS "deep"		**pectoralis major, greater part "superficial"** O: sternum I: middle H	**pectoralis major, sternal** O: sternum I: DP ridge + LT	**pectoralis superficialis pars posticus** O: sternum I: lateral pectoral process	**pectoralis superficialis pars posticus** O: sternum I: lateral pectoral process	**pectoralis superficialis posticus** O: manubrium, sternum, ribs 2-7 I: LT + pectoral crest (span bicipital groove)
PECTORALIS PROFUNDUS	**entopectoralis** O: rib 2 - last true rib I: near H head + bicipital groove	**pectoralis major, greater part "deep anterior"** O: sternum, ribs 1-6 I: GHj capsule	**pectoralis minor** absent	**pectoralis profundus** O: manubrium + ribs I: lateral pectoral ridge	**pectoralis profundus** O: manubrium + ribs I: lateral pectoral ridge	**pectoralis profundus** absent
PECTORALIS ABDOMINALIS		**pectoralis major, greater part "deep posterior"** O: aponeurosis of external oblique I: bicipital groove, w/ PC		**pectoralis abdominalis** O: rectus abdominalis + external oblique I: pectoral crest H	**pectoralis abdominalis** O: rectus abdominalis + external oblique I: pectoral crest H	**pectoralis abdominalis** O: rectus abdominalis + external oblique I: w/ PSd
SUBCLAVIUS	**subclavius** O: rib 1 I: lateral clavicle	**subclavius** O: rib 1 I: lateral clavicle	**subclavius**	**subclavius (3 heads)** O: manubrium + rib 1 I: clavicle + metacromion	**subclavius (3 heads)** O: manubrium + rib 1 I: clavicle + metacromion	**subclavius** O: rib 1 I: medial clavicle
STERNOSCAPULARIS			**sterno-costalis**			**costoscapularis ventralis** O: manubrium + rib 1 I: lateral clavicle
CORACOBRACHIALIS	**coracoideus caput breves** O: coracoid process I: medial H	**coraco-brachialis longus et brevis** O: 2 heads, coracoid process I: medial supracondylar bridge over entepicondylar foramen; w/TMA	**coraco-brachialis** absent	**coracobrachialis** absent	**coracobrachialis** absent	**coracobrachialis** absent
CORACOBRACHIALIS	**coracoideus caput longus** O: coracoid process I: near medial epicondyle					
BICEPS BRACHII, short head		**biceps** O: coracoid process				
BICEPS BRACHII, long head	**biceps** O: glenoid + coracoid I: U + R	**biceps** O: glenoid rim I: 2 parts, R + U	**biceps** O: coracoid process I: R	**biceps brachii** O: rim glenoid I: R	**biceps brachii** O: rim glenoid I: R	**biceps brachii** O: rim glenoid I: R

	Soricomorpha continued					
	Solenodontidae		**Talpidae**			
	Solenodon **Allen, 1910**	***Solenodon*** **Dobson, 1882b**	***Desmana*** **Dobson, 1883**	***Desmana*** **Whidden, 2000**	***Galemys*** **Whidden, 2000**	***Neurotrichus*** **Reed, 1951**
BRACHIALIS	**brachialis** O: caudal H I: medial R		**brachialis anticus** O: neck H, LT to GT I: medial U	**brachialis** O: caudal + lateral H I: U	**brachialis** O: caudal + lateral H I: U	**brachialis** O: caudal proximal H I: U
CUBITALIS						
SUPRASPINATUS	**supraspinatus** O: supraspinous fossa I: GT		**supra-spinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: pit at base GT	**supraspinatus** O: supraspinous fossa I: pit at base GT	**supraspinatus** O: supraspinous fossa I: GT
INFRASPINATUS	**infraspinatus** O: infraspinous fossa I: GT		**infra-spinatus** O: caudal surface spine of scapula I: GT	**infraspinatus** O: infraspinous fossa I: GT + H head	**infraspinatus** O: infraspinous fossa I: GT + H head	**infraspinatus** O: infraspinous fossa I: GT
TRICEPS BRACHII CAPUT LATERALE	**ectotriceps** O: DP crest I: lateral olecranon		**triceps, outer** O: base GT I: lateral olecranon	**triceps brachii, caput lateralis** O: lateral GT I: lateral olecranon	**triceps brachii, caput lateralis** O: lateral GT I: lateral olecranon	**triceps, superficial lateral** O: lateral GT + H I: lateral olecranon
TRICEPS BRACHII CAPUT MEDIALE	**entotriceps** O: caudal H just distal to head I: medial olecranon		**triceps, inner** O: medial H I: olecranon	**triceps brachii, caput medialis** O: cranial + caudal H I: olecranon (2 parts)	**triceps brachii, caput medialis** O: cranial + caudal H I: olecranon (2 parts)	**triceps, medial** O: caudal teres tubercle + LT I: medial olecranon
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**meditriceps** O: caudal border scapula I: olecranon	**triceps, scapular** I: caudo-lateral olecranon	**triceps, scapular inner** O: neck of scapula I: lateral olecranon	**triceps brachii, caput longus** O: spine between teres fossa + infraspinous fossa I: olecranon	**triceps brachii, caput longus** O: spine between teres fossa + infraspinous fossa I: olecranon	**triceps, long** O: caudal border scapula I: olecranon
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)	**entotriceps, second division** O: distal caudo-lateral H I: lateral olecranon		**triceps, scapular outer** O: neck of scapula I: tip olecranon			**triceps, deep lateral** O: caudal LT I: lateral olecranon
TRICEPS BRACHII ACCESSORY						**triceps, deep medial** O: distal caudal H I: olecranon
ANCONEUS	**entotriceps, third division** O: lateral epicondyle		**anconeus externus** O: lateral epicondyle I: lateral U	**anconeus lateralis** O: caudal surface lateral epicondyle I: posterior crest U	**anconeus lateralis** O: caudal surface lateral epicondyle I: posterior crest U	**anconeus lateralis** O: caudal surface lateral epicondyle I: posterior crest U
BRACHIORADIALIS	**supinator longus** absent	**supinator longus** absent	**supinator longus** absent	**brachioradialis** absent	**brachioradialis** absent	**brachioradialis** absent

	Soricomorpha continued					
	Solenodontidae		Talpidae			
	Solenodon **Allen, 1910**	***Solenodon*** **Dobson, 1882b**	***Desmana*** **Dobson, 1883**	***Desmana*** **Whidden, 2000**	***Galemys*** **Whidden, 2000**	***Neurotrichus*** **Reed, 1951**
EXT CARPI RADIALIS, longus (MC2)	**ext (carpi) radialis longior et brevior** O: cranial epicondylar ridge I: MC 2 + 3	**ext carpi radialis** O: lateral supracondylar crest I: base MC2 + 3	**ext carpi radialis** O: lateral H proximal to epicondyle I: base MC2 + 3	**ext carpi radialis** O: lateral epicondyle I: medial MC3	**ext carpi radialis** O: lateral epicondyle I: medial MC3	**ext carpi radialis** O: lateral epicondyle I: MC2 + 3
EXT CARPI RADIALIS, brevis (MC3)						
EXT DIGITORUM COMMUNIS	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext communis digitorum** O: w/ EDL lateral epicondyle + U I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle (3 heads) I: digits 2, 3, 3, 4, 4, 5	**ext digitorum communis** O: lateral epicondyle (3 heads) I: digits 2, 3, 3, 4, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 1, 2, 3, 3, 4, 5
EXT DIGITORUM LATERALIS	**ext minimi digiti** O: lateral epicondyle I: digits 4 + 5	**ext minimi digiti** O: w/ EDC I: digits 4, 5	**ext minimi digiti** O: w/ EDC lateral epicondyle + U I: digits 4 + 5	**ext digiti quinti proprius** O: olecranon + lateral epicondyle I: digits 4, 5	**ext digiti quinti proprius** O: olecranon + lateral epicondyle I: digits 4, 5	**ext digiti quinti proprius** O: lateral epicondyle + U I: digits 4, 5
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle I: MC5		**ext carpi ulnaris** O: lateral epicondyle + U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + U I: ulnar sesamoid	**ext carpi ulnaris** O: lateral epicondyle + U I: ulnar sesamoid	**ext carpi ulnaris** O: lateral epicondyle I: base MC5
SUPINATOR		**supinator brevis** "very small"	**supinator brevis** absent	**supinator** O: lateral epicondyle I: medial proximal R	**supinator** O: lateral epicondyle I: medial proximal R	**supinator** O: lateral epicondyle I: proximal R
ABD POLLICIS LONGUS	**ext ossis metacarpi pollicis** O: R + U I: MC1 + radial sesamoid	**extensor ossis metacarpi pollicis** O: lateral U I: base MC1	**ext ossis metacarpi pollicis** O: proximal lateral U + R I: MC1	**abd pollicis longus** O: U + R I: MC1	**abd pollicis longus** O: U + R I: MC1	**abd pollicis longus** O: lateral olecranon + R I: base MC1
EXT DIGITORUM PROFUNDUS	**indicator** O: U I: digit 1 + 2	**ext secundi internodii pollicis et extensor indicis** O: U + R I: digits 1, 2, 3	**ext secundi internodii pollicis et ext indicis** O: proximal lateral U I: digit 1 + 2	**ext indicis et pollicis longus** O: lateral olecranon I: digits 1, 2	**ext indicis et pollicis longus** O: lateral olecranon I: digits 1, 2	**ext indicis et pollicis longus** O: olecrnaon I: digits 1, 2
PRONATOR TERES	**pronator teres** O: medial epicondyle I: middle R	**pronator radii teres** O: medial epicondyle I: middle R	**pronator radii teres** O: medial epicondyle I: middle R	**pronator radii teres** O: medial epicondyle I: R	**pronator radii teres** O: medial epicondyle I: R	**pronator radii teres** O: medial epicondyle I: distal R

	Soricomorpha continued					
	Solenodontidae		Talpidae			
	Solenodon **Allen, 1910**	*Solenodon* **Dobson, 1882b**	*Desmana* **Dobson, 1883**	*Desmana* **Whidden, 2000**	*Galemys* **Whidden, 2000**	*Neurotrichus* **Reed, 1951**
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: MC3		**flx carpi radialis** O: medial epicondyle I: MC2	**flx carpi radialis** O: near entepicondylar foramen I: MC3	**flx carpi radialis** O: near entepicondylar foramen I: MC3	**flx carpi radialis** O: medial epicondyle I: base palmar MC2
PALMARIS LONGUS		**palmaris** O: medial epicondyle w/ FDS + FCU I: palmar fascia	**palmaris longus** O: medial epicondyle w/ FCU I: digit 5 + palmar fascia	**palmaris longus** O: medial epicondyle I: falciform + digit 5	**palmaris longus** O: medial epicondyle I: falciform + digit 5	**palmaris longus** O: tip medial epicondyle I: palmar fascia + digits 1 (sesamoid) + 2
FLX DIGITORUM SUPERFICIALIS	**flx sublimis digitorum** O: medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum sublmis** O: medial epicondyle	**flx digitorum sublimis** O: medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum superficialis** O: medial epicondyle (3 heads) I: digits 2f, 3f, 4f	**flx digitorum superficialis** O: medial epicondyle (3 heads) I: digits 2f, 3f, 4f	**flx digitorum sublimis** O: medial epicondyle (3 heads) I: digits 2f, 3f, 4f
INTERFLEXORII		absent				
FLX DIGITORUM PROFUNDUS,	**flx digitorum profundus, superficial head**	**flx digitorum profundus, superficial head**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**
epicondylar	O: between medial epicondyle + U	O: medial epicondyle		= flexor ligament	= flexor ligament	O: caudal medial epicondyle
epicondylar (FDPe)	O: medial epicondyle w/ FDS I: medial F	O: medial epicondyle w/ FDS I: medial F	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: olecranon
epicondylar (FDPd)	O: medial epicondyle	O: medial epicondyle	O: R I: pollex	O: U	O: U	O: U
ulnar	O: U	O: U + R	O: U	O: U	O: U	O: medial olecranon
radial	O: R *I: digits 1, 2, 3, 4, 5	O: U + R *I: digits 1, 2, 3, 4, 5	O: R I: deep surface FDPe *I: digits 1, 2, 3, 4, 5	O: R	O: R	O: R *I: digits 1, 2, 3, 4, 5
LUMBRICALES		**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** absent			
FLX CARPI ULNARIS,	**flx carpi ulnaris**		**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**
epitrochlear belly	O: medial epicondyle		O: medial epicondyle w/ PL	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle
ulnar belly	 I: pisiform		O: U I: pisiform	O: olecranon I: pisiform	O: olecranon I: pisiform	O: olecranon I: pisiform

	Soricomorpha continued					
	Solenodontidae		Talpidae			
	Solenodon **Allen, 1910**	***Solenodon*** **Dobson, 1882b**	***Desmana*** **Dobson, 1883**	***Desmana*** **Whidden, 2000**	***Galemys*** **Whidden, 2000**	***Neurotrichus*** **Reed, 1951**
EPITROCHLEO-ANCONEUS			**anconeus-epitrochlearis vel internus** O: ridge superior to supracondylar foramen I: medial olecranon	**epitrochleo-anconeus** O: medial epicondyle I: olecranon	**epitrochleo-anconeus** O: medial epicondyle I: olecranon	**epitrochleo-anconeus** O: medial epicondyle I: olecranon
PRONATOR QUADRATUS				**pronator quadratus** absent	**pronator quadratus** absent	**pronator quadratus** O: R + U
PALMARIS BREVIS						
FLX DIGITORUM BREVES MANUS				**flx brevis digitorum manus** absent	**flx brevis digitorum manus** absent	
ABD DIGITI MINIMI				**abd digiti quinti** O: pisiform I: sesamoid at MCPj5	**abd digiti quinti** absent	
ABD POLLICIS BREVIS				**abd pollicis brevis** O: radiale I: sesamoid at MCPj1	**abd pollicis brevis** absent	
CONTRAHENTES		**adductors** I: digits 1, 2, 5				
FLEXOR BREVES PROFUNDUS		**flexores breves** 10	**flexores breves + adductor pollicis** 9	**flexores breves** 5	**flexores breves** 10	**flexores breves** 6
INTERMETACARPALES						**interossei dorsales** absent
? Unknown homology						**costoscapularis dosralis** O: manubrium +
RADIAL SESAMOID "PRE-POLLUX"	present					
ULNAR SESAMOID						
CARPAL VIBRISSAE						

	Soricomorpha continued Talpidae continued *Neurotrichus* **Whidden, 2000**	**Scaptonyx Whidden, 2000**	**Talpa Julien, 1967**	**Talpa Whidden, 2000**	**Uropsilus Whidden, 2000**	**Urotrichus Whidden, 2000**
PANNICULUS CARNOSUS	**cutaneus maximus** O: dorsum I: lateral pectoral process near PA + PSd	**cutaneus maximus** O: dorsum I: lateral pectoral process near PA + PSd		**cutaneus maximus** O: dorsum I: lateral pectoral process near PA + PSd	**cutaneus maximus** O: dorsum I: lateral pectoral process near PA + PSd	**cutaneus maximus** O: dorsum I: lateral pectoral process near PA + PSd
STERNO-FACIALIS	**sterno-occipitalis** O: lateral skull w/ CT I: manubrium	**sterno-occipitalis** O: lateral skull w/ CT I: manubrium	**?sterno-occipital** O: exoccipital I: sternum	**sterno-occipitalis** O: lateral skull w/ CT I: manubrium	**sterno-occipitalis** O: lateral skull w/ CT I: manubrium	**sterno-occipitalis** O: lateral skull w/ CT I: manubrium
STERNOMASTOIDEUS	**sternomastoideus** O: base zygomatic arch w/ CM I: manubrium	**sternomastoideus** O: base zygomatic arch w/ CM I: manubrium	**sterno-mastoïdien** O: near EAM I: sternum	**sternomastoideus** O: base zygomatic arch w/ CM I: manubrium	**sternomastoideus** O: base zygomatic arch w/ CM I: manubrium	**sternomastoideus** O: base zygomatic arch w/ CM I: manubrium
CLEIDOMASTOIDEUS	**cleidomastoideus** O: base zygomatic arch w/ SM I: medial clavicle	**cleidomastoideus** O: base zygomatic arch w/ SM I: medial clavicle	**cléido-mastoïdien** O: near EAM I: clavicle	**cleidomastoideus** O: base zygomatic arch w/ SM I: medial clavicle	**cleidomastoideus** O: base zygomatic arch w/ SM I: manubrium	**cleidomastoideus** O: base zygomatic arch w/ SM I: medial clavicle
CLAVOTRAPEZIUS	**cleido-occipitalis** O: lateral skull w/ SMs I: medial clavicle	**cleido-occipitalis** O: lateral skull w/ SMs I: medial clavicle	**?cléido-occipital** O: exoccipital I: clavicle	**cleido-occipitalis** O: lateral skull w/ SMs I: medial clavicle	**cleido-occipitalis** O: lateral skull w/ SMs I: manubrium	**cleido-occipitalis** O: lateral skull w/ SMs I: medial clavicle
CEPHALOHUMERALIS						
ACROMIOTRAPEZIUS	**trapezius anticus, pars cervicis** O: occiput + ligamentum nuchae I: metacromion	**trapezius anticus, pars cervicis** O: occiput + ligamentum nuchae I: metacromion	**trapèze antérieur** O: ligamentum nuchae I: acromio-clavicular ligament	**trapezius anticus, pars cervicis** O: ligamentum nuchae I: fascia over GT + humeroclavicular tendon	**trapezius anticus, pars capitis + pars cervicis** O: occiput / ligamentum nuchae I: metacromion / metacromion bifid	**trapezius anticus, pars cervicis** O: occiput + ligamentum nuchae I: metacromion
DORSO-CUTANEUS	**dorsocuticularis** O: L4-6 I: skin of back	**dorsocuticularis** O: L4-6 I: skin of back		**dorsocuticularis** O: L3 I: skin of back	**dorsocuticularis** O: last L vertebra + iliac crest I: skin of back	**dorsocuticularis** O: L4-6 I: skin of back
SPINOTRAPEZIUS	**trapezius posticus** O: lumbar vertebrae I: tuber spinae	**trapezius posticus** O: lumbar vertebrae I: tuber spinae	**trapèze postérieur** O: L1 I: tuberosity base scap spine	**trapezius posticus** O: lumbar vertebrae I: tuber spinae	**trapezius posticus** O: lumbar vertebrae I: tuber spinae	**trapezius posticus** O: lumbar vertebrae I: tuber spinae

	Soricomorpha continued Talpidae continued					
	Neurotrichus **Whidden, 2000**	**Scaptonyx Whidden, 2000**	**Talpa Julien, 1967**	**Talpa Whidden, 2000**	**Uropsilus Whidden, 2000**	**Urotrichus Whidden, 2000**
RHOMBOIDEUS CAPITIS	**r. capitis** O: occiput I: vertebral border scapula	**r. capitis** O: occiput I: vertebral border scapula	**r. occipital** O: occiput I: vertebral border + infraspinous fossa	**r. capitis** O: occiput I: vertebral border scapula	**r. capitis** O: occiput I: vertebral border scapula	**r. capitis** O: occiput I: vertebral border scapula
RHOMBOIDEUS CERVICIS	**r. cervicis** O: ligamentum nuchae I: vertebral border scapula	**r. cervicis** O: ligamentum nuchae I: vertebral border scapula	**r. cervical** O: C verts I: vertebral border + infraspinous fossa	**r. cervicis** O: ligamentum nuchae I: vertebral border scapula	**r. cervicis** O: ligamentum nuchae I: vertebral border scapula	**r. cervicis** O: ligamentum nuchae I: vertebral border scapula
RHOMBOIDEUS THORACIS	**r. posticus** O: dorsal raphe I: vertebral border scapula	**r. posticus** O: dorsal raphe I: vertebral border scapula	**r. dorsal** O: T1-2 I: distal vertebral border + raphe w/ opposite RT	**r. posticus** O: ligament + T2-3 I: interscapular ligament	**r. posticus** O: dorsal raphe I: vertebral border scapula	**r. posticus** O: dorsal raphe I: vertebral border scapula
OMOTRANSVERSARIUS	**atlantoscapularis anterior** absent	**atlantoscapularis anterior** absent	**acromio-trachélien** "absent"	**atlantoscapularis anterior** absent	**atlantoscapularis anterior** O: atlas I: metacromion	**atlantoscapularis anterior** absent
OMOTRANSVERSARIUS	**atlantoscapularis posterior** absent	**atlantoscapularis posterior** absent		**atlantoscapularis posterior** absent	**atlantoscapularis posterior** O: atlas I: vertebral border scapula	**atlantoscapularis posterior** absent
OMOHYOIDEUS	**omohyoideus** absent	**omohyoideus** absent		**omohyoideus** absent	**omohyoideus** absent	**omohyoideus** absent
SERRATUS VENTRALIS CERVICIS	**serratus ventralis cervicis** O: C3-7, rib 1 I: deep surface vertebral border scapula	**serratus ventralis cervicis** O: C3-7, rib 1 I: deep surface vertebral border scapula	**elévator de l'omoplate** O: I: cranial angle scapula	**serratus ventralis cervicis** O: C3-7 I: deep surface vertebral border scapula	**serratus ventralis cervicis** O: C3-7, rib 1 I: deep surface vertebral border scapula	**serratus ventralis cervicis** O: C3-7, rib 1 I: deep surface vertebral border scapula
SERRATUS VENTRALIS THORACIS	**serratus ventralis thoracis** O: ribs 3-10 I: deep surface vertebral border scapula	**serratus ventralis thoracis** O: ribs 3-10 I: deep surface vertebral border scapula	**grand dentelé** I: deep surface vertebral border	**serratus ventralis thoracis** O: ribs 3-10 I: deep surface vertebral border scapula	**serratus ventralis thoracis** O: ribs 3-8 I: deep surface vertebral border scapula	**serratus ventralis thoracis** O: ribs 3-10 I: deep surface vertebral border scapula
CLAVODELTOIDEUS	**cleidodeltoideus** O: lateral clavicle I: deltoid fossa H	**cleidodeltoideus** O: lateral clavicle I: deltoid fossa H	**cléido-deltoïde** O: clavicle I: w/ AD on DP crest	**cleidodeltoideus** O: lateral clavicle I: deltoid fossa H	**cleidodeltoideus** O: lateral clavicle I: deltoid fossa H	**cleidodeltoideus** O: lateral clavicle I: deltoid fossa H

	Soricomorpha continued					
	Talpidae continued					
	Neurotrichus Whidden, 2000	Scaptonyx Whidden, 2000	Talpa Julien, 1967	Talpa Whidden, 2000	Uropsilus Whidden, 2000	Urotrichus Whidden, 2000
ACROMIODELTOIDEUS	**acromiodeltoideus** O: lateral clavicle I: deltoid fossa H	**acromiodeltoideus** O: lateral clavicle I: deltoid fossa H	**acromio-deltoïde** O: clavicle I: w/ CD on DP crest	**acromiodeltoideus** O: lateral clavicle I: deltoid fossa H	**acromiodeltoideus** O: acromion I: pectoral ridge H	**acromiodeltoideus** O: lateral clavicle I: deltoid fossa H
SPINODELTOIDEUS	**spinodeltoideus** O: tuber spinae + spine scapula I: deltoid process H	**spinodeltoideus** O: tuber spinae + spine scapula I: deltoid process H	**spino-deltoïde** O: spine scapula I: DP crest	**spinodeltoideus** O: tuber spinae + spine scapula I: deltoid process H	**spinodeltoideus** O: tuber spinae + spine scapula I: deltoid process H	**spinodeltoideus** O: tuber spinae + spine scapula I: deltoid process H
TERES MINOR			**petit rond** "does not exist"			
SUBSCAPULARIS	**subscapularis** O: subscapular fossa + caudal border scapula (2 heads) I: LT	**subscapularis** O: subscapular fossa + caudal border scapula (2 heads) I: LT	**sous-scapulaire** O: bipart; subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa + caudal border scapula (2 heads) I: LT	**subscapularis** O: subscapular fossa + caudal border scapula (2 heads) I: LT
TERES MAJOR	**teres major** O: subscapularis + vertebral border scapula I: teres tubercle H	**teres major** O: subscapularis + vertebral border scapula I: teres tubercle H	**grand rond** O: caudal border + neck scapula I: w/ LD on teres tuber	**teres major** O: teres fossa + vertebral border scapula I: teres tubercle H	**teres major** O: cranial angle scapula I: teres tubercle H	**teres major** O: subscapularis + vertebral border scapula I: teres tubercle H
LATISSIMUS DORSI	**latissimus dorsi** O: last T vertebrae, fascia lumbar region I: TMA	**latissimus dorsi** O: last T vertebrae, fascia lumbar region I: TMA	**grand dorsal** O: 2 parts, anterio + posterior from T + L verts I: both to TMA tendon * 2 parts	**latissimus dorsi** O: last T vertebrae, fascia lumbar region I: TMA	**latissimus dorsi** O: last T vertebrae, fascia lumbar region I: teres tubercle H	**latissimus dorsi** O: last T vertebrae, fascia lumbar region I: TMA
DORSO-EPITROCHLEARIS	**dorsoepitrochlearis** O: LD I: fascia forearm flexors	**dorsoepitrochlearis** O: LD I: fascia forearm flexors	**dorso-épitrochléo-olécrânien** O: LD I: caudal olecranon	**dorsoepitrochlearis** O: LD I: fascia forearm flexors	**dorsoepitrochlearis** O: LD I: fascia forearm flexors	**dorsoepitrochlearis** O: LD I: fascia forearm flexors
PECTORALIS SUPERFICIALIS "clavicular"						
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis superficialis pars anticus** O: manubrium + ventral raphe I: medial pectoral process H	**pectoralis superficialis pars anticus** O: manubrium + ventral raphe I: medial pectoral process H	**grand pectoral, sternal anterieure** O: manubrium I: DP crest	**pectoralis superficialis pars anticus** O: manubrium + ventral raphe I: medial pectoral process H	**pectoralis superficialis pars anticus** O: manubrium + ventral raphe I: medial pectoral process H	**pectoralis superficialis pars anticus** O: manubrium + ventral raphe I: medial pectoral process H

	Soricomorpha continued					
	Talpidae continued					
	Neurotrichus Whidden, 2000	**Scaptonyx Whidden, 2000**	**Talpa Julien, 1967**	**Talpa Whidden, 2000**	**Uropsilus Whidden, 2000**	**Urotrichus Whidden, 2000**
PECTORALIS SUPERFICIALIS "deep"	**pectoralis superficialis pars posticus** O: sternum I: lateral pectoral process	**pectoralis superficialis pars posticus** O: sternum I: lateral pectoral process	**grand pectoral, sternal posteriuer** O: manubrium + sternum + ribs I: distal DP crest	**pectoralis superficialis pars posticus** O: sternum I: lateral pectoral process	**pectoralis superficialis pars posticus** O: sternum I: lateral pectoral process	**pectoralis superficialis pars posticus** O: sternum I: lateral pectoral process
PECTORALIS PROFUNDUS	**pectoralis profundus** O: manubrium + ribs I: lateral pectoral ridge	**pectoralis profundus** O: manubrium + ribs I: lateral pectoral ridge	**petit pectoral** O: manubrium I: LT	**pectoralis profundus** O: manubrium + ribs I: lateral pectoral ridge	**pectoralis profundus** O: manubrium + ribs I: lateral pectoral ridge	**pectoralis profundus** O: manubrium + ribs I: lateral pectoral ridge
PECTORALIS ABDOMINALIS	**pectoralis abdominalis** O: rectus abdominalis + external oblique I: pectoral crest H	**pectoralis abdominalis** O: rectus abdominalis + external oblique I: pectoral crest H	**grand pectoral, abdominal** O: external oblique I: w/ PSd	**pectoralis abdominalis** O: rectus abdominalis + external oblique I: pectoral crest H	**pectoralis abdominalis** O: rectus abdominalis + external oblique I: pectoral crest H	**pectoralis abdominalis** O: rectus abdominalis + external oblique I: pectoral crest H
SUBCLAVIUS	**subclavius (3 heads)** O: manubrium + rib 1 I: metacromion + clavicle	**subclavius (3 heads)** O: manubrium + rib 1 I: metacromion + clavicle	**sous-clavier** O: costal cartilage 1 I: lateral clavicle	**subclavius (3 heads)** O: manubrium + rib 1 I: clavicle + acromion	**subclavius (3 heads)** O: manubrium + rib 1 I: clavicle	**subclavius (3 heads)** O: manubrium + rib 1 I: metacromion + clavicle
STERNOSCAPULARIS			**costo-scapulaire** O: manubrium I: clavicle + acromio-clavicular ligament			
CORACOBRACHIALIS	**coracobrachialis** absent	**coracobrachialis** absent	**coraco-brachial** - -	**coracobrachialis** absent	**coracobrachialis** O: coracoid process I: H near teres tubercle	**coracobrachialis** absent
CORACOBRACHIALIS			- -			
BICEPS BRACHII, short head					**biceps brachii** O: coracoid process I: w/ BBl	
BICEPS BRACHII, long head	**biceps brachii** O: rim glenoid I: R	**biceps brachii** O: rim glenoid I: R	**biceps** O: subscapular fossa just beyond glenoid rim I: caudal R	**biceps brachii** O: rim glenoid I: R	**biceps brachii** O: rim glenoid I: R	**biceps brachii** O: rim glenoid I: R

	Soricomorpha continued Talpidae continued *Neurotrichus* **Whidden, 2000**	 **Scaptonyx** **Whidden, 2000**	 **Talpa** **Julien, 1967**	 **Talpa** **Whidden, 2000**	 **Uropsilus** **Whidden, 2000**	 **Urotrichus** **Whidden, 2000**
BRACHIALIS	**brachialis** O: caudal + lateral H I: U	**brachialis** O: caudal + lateral H I: U	**brachial antérieur** O: caudal H I: medial U	**brachialis** O: caudal + lateral H I: U	**brachialis** O: caudal + lateral H I: U	**brachialis** O: caudal + lateral H I: U
CUBITALIS						
SUPRASPINATUS	**supraspinatus** O: supraspinous fossa I: pit at base GT	**supraspinatus** O: supraspinous fossa I: pit at base GT	**sus-épineux** O: supraspinous fossa I: past GT on neck H	**supraspinatus** O: supraspinous fossa I: pit at base GT	**supraspinatus** O: supraspinous fossa I: pit at base GT	**supraspinatus** O: supraspinous fossa I: pit at base GT
INFRASPINATUS	**infraspinatus** O: infraspinous fossa I: GT + H head	**infraspinatus** O: infraspinous fossa I: GT + H head	**sous-épineux** "disappeared"	**infraspinatus** absent	**infraspinatus** O: infraspinous fossa I: GT + H head	**infraspinatus** O: infraspinous fossa I: GT + H head
TRICEPS BRACHII CAPUT LATERALE	**triceps brachii, caput lateralis** O: lateral GT + caudal H I: lateral olecranon	**triceps brachii, caput lateralis** O: lateral GT + caudal H I: lateral olecranon	**triceps vaste externe** O: lateral H + neck I: olecranon	**triceps brachii, caput lateralis** O: lateral GT + caudal H I: lateral olecranon	**triceps brachii, caput lateralis** O: lateral GT I: lateral olecranon	**triceps brachii, caput lateralis** O: lateral GT + caudal H I: lateral olecranon
TRICEPS BRACHII CAPUT MEDIALE	**triceps brachii, caput medialis** O: cranial + caudal H I: olecranon (2 parts)	**triceps brachii, caput medialis** O: cranial + caudal H I: olecranon (2 parts)	**triceps vaste interne** O: medial to DP crest I: olecranon	**triceps brachii, caput medialis** O: cranial + caudal H + TMA I: olecranon (2 parts)	**triceps brachii, caput medialis** O: medial H I: olecranon	**triceps brachii, caput medialis** O: cranial + caudal H I: olecranon (2 parts)
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps brachii, caput longus** O: spine between teres fossa + infraspinous fossa I: olecranon	**triceps brachii, caput longus** O: spine between teres fossa + infraspinous fossa I: olecranon	**triceps long chef** O: caudal border scapula I: olecranon	**triceps brachii, caput longus** O: spine between teres fossa + infraspinous fossa I: olecranon	**triceps brachii, caput longus** O: spine between teres fossa + infraspinous fossa I: olecranon	**triceps brachii, caput longus** O: spine between teres fossa + infraspinous fossa I: olecranon
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)			**triceps long chef** O: caudal border scapula I: olecranon			
TRICEPS BRACHII ACCESSORY						
ANCONEUS	**anconeus lateralis** O: caudal surface lateral epicondyle I: posterior crest U	**anconeus lateralis** O: caudal surface lateral epicondyle I: posterior crest U	**epicondylo-cubital** O: caudal H epicondyle, very large I: lateral olecranon	**anconeus lateralis** O: caudal surface lateral epicondyle I: posterior crest U	**anconeus lateralis** O: caudal surface lateral epicondyle I: posterior crest U	**anconeus lateralis** O: caudal surface lateral epicondyle I: posterior crest U
BRACHIORADIALIS	**brachioradialis** absent	**brachioradialis** absent	**brachio-radial** absent	**brachioradialis** absent	**brachioradialis** absent	**brachioradialis** absent

	Soricomorpha continued Talpidae continued *Neurotrichus* Whidden, 2000	Scaptonyx Whidden, 2000	Talpa Julien, 1967	Talpa Whidden, 2000	Uropsilus Whidden, 2000	Urotrichus Whidden, 2000
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis** O: lateral epicondyle I: medial MC3	**ext carpi radialis** O: lateral epicondyle I: medial MC3	**extenseur radial du carpe** O: supracondylar crest + caudal H I: MC3	**ext carpi radialis** O: lateral epicondyle I: medial MC3	**ext carpi radialis** O: lateral epicondyle I: medial MC3	**ext carpi radialis** O: lateral epicondyle I: medial MC3
EXT CARPI RADIALIS, brevis (MC3)						
EXT DIGITORUM COMMUNIS	**ext digitorum communis** O: lateral epicondyle (3 heads) I: digits 2, 3, 3, 4, 4, 5	**ext digitorum communis** O: lateral epicondyle (3 heads) I: digits 2, 3, 3, 4, 4, 5	**extenseur commun des doigts** O: lateral supracondylar crest I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle (3 heads) I: digits 2, 3, 3, 4, 4, 5	**ext digitorum communis** O: lateral epicondyle (2 heads) I: digits 2, 3, 4, 4, 5	**ext digitorum communis** O: lateral epicondyle (3 heads) I: digits 2, 3, 3, 4, 4, 5
EXT DIGITORUM LATERALIS	**ext digiti quinti proprius** O: olecranon + lateral epicondyle I: digits 4, 5	**ext digiti quinti proprius** O: olecranon + lateral epicondyle I: digits 4, 5	**extenseur du V** O: w/ ECU lateral epicondyle + olecranon I: digit 5	**ext digiti quinti proprius** O: olecranon + lateral epicondyle I: digit 5	**ext digiti quinti proprius** O: lateral epicondyle I: digits 4, 5	**ext digiti quinti proprius** O: olecranon + lateral epicondyle I: digits 4, 5
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle + U I: ulnar sesamoid	**ext carpi ulnaris** O: lateral epicondyle + U I: ulnar sesamoid	**extenseur cubital du carpe** O: w/ EDL I: base MC4	**ext carpi ulnaris** O: lateral epicondyle I: lateral digit 4	**ext carpi ulnaris** O: lateral epicondyle + U I: MC5	**ext carpi ulnaris** O: lateral epicondyle + U I: ulnar sesamoid
SUPINATOR	**supinator** O: lateral epicondyle I: medial proximal R	**supinator** O: lateral epicondyle I: medial proximal R	**supinateur** O: lateral epicondyle I: cranial R	**supinator** O: lateral epicondyle I: medial proximal R	**supinator** O: lateral epicondyle I: medial proximal R	**supinator** O: lateral epicondyle I: medial proximal R
ABD POLLICIS LONGUS	**abd pollicis longus** O: U + R I: MC1	**abd pollicis longus** O: U + R I: MC1	**long abducteur du pouce**	**abd pollicis longus** O: U + R I: MC1	**abd pollicis longus** O: U + R I: MC1	**abd pollicis longus** O: U + R I: MC1
EXT DIGITORUM PROFUNDUS	**ext indicis et pollicis longus** O: lateral olecranon I: digits 1, 2	**ext indicis et pollicis longus** O: lateral olecranon I: digits 1, 2	**extenseur profond des doigts** O: cranio-lateral olecranon I: digit 2	**ext indicis et pollicis longus** O: lateral olecranon I: digits 1, 2	**ext indicis et pollicis longus** O: lateral olecranon I: digits 1, 2	**ext indicis et pollicis longus** O: lateral olecranon I: digits 1, 2
PRONATOR TERES	**pronator radii teres** O: medial epicondyle I: R	**pronator radii teres** O: medial epicondyle I: R	**rond pronateur** O: medial epicondyle I: cranial R	**pronator radii teres** O: medial epicondyle I: R	**pronator radii teres** O: medial epicondyle I: R	**pronator radii teres** O: medial epicondyle I: R

	Soricomorpha continued					
	Talpidae continued					
	Neurotrichus **Whidden, 2000**	**Scaptonyx Whidden, 2000**	**Talpa Julien, 1967**	**Talpa Whidden, 2000**	**Uropsilus Whidden, 2000**	**Urotrichus Whidden, 2000**
FLX CARPI RADIALIS	**flx carpi radialis** O: near entepicondylar foramen I: MC3	**flx carpi radialis** O: near entepicondylar foramen I: MC3	**fléchisseur radial du carpe** "does not exist" -	**flx carpi radialis** O: near entepicondylar foramen I: MC2 + 3	**flx carpi radialis** O: near entepicondylar foramen I: MC3	**flx carpi radialis** O: near entepicondylar foramen I: MC3
PALMARIS LONGUS	**palmaris longus** O: medial epicondyle I: falciform + digit 5	**palmaris longus** O: medial epicondyle I: falciform + digit 5	**long palmaire** O: medial epicondyle I: falciform (prepollex) + digit 5	**palmaris longus** O: medial epicondyle I: falciform + digit 5	**palmaris longus** O: medial epicondyle I: palmar fascia	**palmaris longus** O: medial epicondyle I: falciform + digit 5
FLX DIGITORUM SUPERFICIALIS	**flx digitorum superficialis** O: medial epicondyle (3 heads) I: digits 2f, 3f, 4f	**flx digitorum superficialis** O: medial epicondyle (3 heads) I: digits 2f, 3f, 4f	**fléchisseur superficiel des doigts** O: medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum superficialis** O: medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum superficialis** O: medial epicondyle (3 heads) I: digits 2f, 3f, 4f	**flx digitorum superficialis** O: medial epicondyle (3 heads) I: digits 2f, 3f, 4f
INTERFLEXORII						
FLX DIGITORUM PROFUNDUS, **epicondylar** **epicondylar (FDPe)** **epicondylar (FDPd)** **ulnar** **radial**	**flx digitorum profundus** = flexor ligament O: U O: U O: U O: R	**flx digitorum profundus** = flexor ligament O: U O: U O: U O: R	**fléchisseur profond des doigts** fibro-tendon band fibro-tendon band O: ulna - *I: digits 1, 2, 3, 4, 5	**flx digitorum profundus** = flexor ligament O: medial epicondyle O: U O: U -	**flx digitorum profundus** O: medial epicondyle O: medial epicondyle O: U O: U O: R	**flx digitorum profundus** = flexor ligament O: U O: U O: U O: R
LUMBRICALES			**lombricaux** - -			
FLX CARPI ULNARIS, **epitrochlear belly** **ulnar belly**	**flx carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform	**fléchisseur cubital du carpe** O: medial olecranon I: pisiform	**flx carpi ulnaris** - O: olecranon I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform

	Soricomorpha continued					
	Talpidae continued					
	Neurotrichus Whidden, 2000	Scaptonyx Whidden, 2000	Talpa Julien, 1967	Talpa Whidden, 2000	Uropsilus Whidden, 2000	Urotrichus Whidden, 2000
EPITROCHLEO-ANCONEUS	**epitrochleo-anconeus** O: medial epicondyle I: olecranon	**epitrochleo-anconeus** O: medial epicondyle I: olecranon	**épitrochléo-olécrânien** O: medial epicondyle I: medial olecranon	**epitrochleo-anconeus** O: medial epicondyle + caudal H (2 heads) I: olecranon	**epitrochleo-anconeus** O: medial epicondyle I: olecranon	**epitrochleo-anconeus** O: medial epicondyle I: olecranon
PRONATOR QUADRATUS	**pronator quadratus** absent	**pronator quadratus** absent	**carré pronateur** absent	**pronator quadratus** absent	**pronator quadratus** absent	**pronator quadratus** absent
PALMARIS BREVIS			**court palmaire** absent			
FLX DIGITORUM BREVES MANUS	**flx brevis digitorum manus** absent	**flx brevis digitorum manus** absent	**court fléchisseur des doigts de la main** - -	**flx brevis digitorum manus** absent	**flx brevis digitorum manus** absent	**flx brevis digitorum manus** absent
ABD DIGITI MINIMI	**abd digiti quinti** absent	**abd digiti quinti** absent		**abd digiti quinti** absent	**abd digiti quinti** O: pisiform I: sesamoid at MCPj5	**abd digiti quinti** absent
ABD POLLICIS BREVIS	**abd pollicis brevis** O: radiale I: sesamoid at MCPj1	**abd pollicis brevis** O: radiale I: sesamoid at MCPj1	**abducteur du I**	**abd pollicis brevis** O: radiale I: sesamoid at MCPj1	**abd pollicis brevis** O: radiale I: sesamoid at MCPj1	**abd pollicis brevis** O: radiale I: sesamoid at MCPj1
CONTRAHENTES			**contracteurs des doigts** -			
FLEXOR BREVES PROFUNDUS	**flexores breves** 0	**flexores breves** 0	**muscles interosseux**	**flexores breves** 0	**flexores breves** 10	**flexores breves** 0
INTERMETACARPALES						
? Unknown homology						
RADIAL SESAMOID "PRE-POLLUX"						
ULNAR SESAMOID						
CARPAL VIBRISSAE						

	Soricomorpha continued					
	Talpidae continued					
	Condylura Dobson, 1883	Condylura Whidden, 2000	Parascalops Whidden, 2000	Scalopus Whidden, 2000	Scapanus Reed, 1951	Scapanus Whidden, 2000
PANNICULUS CARNOSUS	**humero-dorsales** O: back I: lateral bicipital groove	**cutaneus maximus** O: dorsum I: lateral pectoral process near PA + PSd	**cutaneus maximus** O: dorsum I: lateral pectoral process near PA + PSd	**cutaneus maximus** O: dorsum I: lateral pectoral process near PA + PSd	**cutaneus maximus** I: pectoral process near LT	**cutaneus maximus** O: dorsum I: lateral pectoral process near PA + PSd
STERNO-FACIALIS		**sterno-occipitalis** absent	**sterno-occipitalis** O: lateral skull w/ CT I: manubrium	**sterno-occipitalis** O: lateral skull w/ CT I: manubrium		**sterno-occipitalis** O: lateral skull w/ CT I: manubrium
STERNOMASTOIDEUS	**sterno-mastoid** O: w/ CM mastoid process I: sternum	**sternomastoideus** O: base zygomatic arch w/ CM I: manubrium	**sternomastoideus** O: base zygomatic arch w/ CM I: manubrium	**sternomastoideus** O: base zygomatic arch w/ CM I: manubrium		**sternomastoideus** O: base zygomatic arch w/ CM I: manubrium
CLEIDOMASTOIDEUS	**cleido-mastoid** O: w/ SM mastoid process I: clavicle	**cleidomastoideus** O: base zygomatic arch w/ SM I: medial clavicle	**cleidomastoideus** O: base zygomatic arch w/ SM I: medial clavicle	**cleidomastoideus** O: base zygomatic arch w/ SM I: medial clavicle		**cleidomastoideus** O: base zygomatic arch w/ SM I: medial clavicle
CLAVOTRAPEZIUS	**cleido-occipital** O: occiput I: lateral clavicle	**cleido-occipitalis** O: lateral skull w/ SMs I: medial clavicle	**cleido-occipitalis** O: lateral skull w/ SMs I: medial clavicle	**cleido-occipitalis** O: lateral skull w/ SMs I: medial clavicle		**cleido-occipitalis** O: lateral skull w/ SMs I: medial clavicle
CEPHALOHUMERALIS						
ACROMIOTRAPEZIUS	**trapezius anticus** O: occiput and ligamentum nuchae I: acromion	**trapezius anticus, pars cervicis** O: ligamentum nuchae I: metacromion	**trapezius anticus, pars cervicis** O: ligamentum nuchae I: fascia over GT + humeroclavicular tendon	**trapezius anticus, pars cervicis** O: ligamentum nuchae I: fascia over GT + humeroclavicular tendon	**trapezius anticus** O: ("degenerate") occiput I: ("degenerate") acromion	**trapezius anticus, pars cervicis** O: ligamentum nuchae I: fascia over GT + humeroclavicular tendon
DORSO-CUTANEUS	**dorso-cuticulares** O: ilium + lumbar fascia I: skin neck + head	**dorsocuticularis** O: L4-6 I: skin of back	**dorsocuticularis** O: L3 I: skin of back	**dorsocuticularis** O: L3 I: skin of back		**dorsocuticularis** O: L3 I: skin of back
SPINOTRAPEZIUS	**trapezius posticus** O: ilium + lumbar fascia I: prominence spine of scapula	**trapezius posticus** O: lumbar vertebrae I: tuber spinae	**trapezius posticus** O: lumbar vertebrae I: tuber spinae	**trapezius posticus** O: lumbar vertebrae I: tuber spinae	**trapezius posticus** O: 2-3L + lumbodorsal fascia I: tuber spinae	**trapezius posticus** O: lumbar vertebrae I: tuber spinae

	Soricomorpha continued					
	Talpidae continued					
	Condylura **Dobson, 1883**	**Condylura Whidden, 2000**	**Parascalops Whidden, 2000**	**Scalopus Whidden, 2000**	**Scapanus Reed, 1951**	**Scapanus Whidden, 2000**
RHOMBOIDEUS CAPITIS	**r. anticus, occipital** O: fascia of temporalis I: vertebral border scapula	**r. capitis** O: occiput I: vertebral border scapula	**r. capitis** O: occiput I: vertebral border scapula	**r. capitis** O: occiput I: vertebral border scapula	**r. capitis** O: parietal-occipital suture I: vertebral border scapula	**r. capitis** O: occiput I: vertebral border scapula
RHOMBOIDEUS CERVICIS	**r. anticus, cervical** O: ossified ligamentum nuchae I: vertebral border scapula	**r. cervicis** O: ligamentum nuchae I: vertebral border scapula	**r. cervicis** O: ligamentum nuchae I: vertebral border scapula	**r. cervicis** O: ligamentum nuchae I: vertebral border scapula	**r. cervicis** O: ligamentum nuchae I: vertebral border scapula	**r. cervicis** O: ligamentum nuchae I: vertebral border scapula
RHOMBOIDEUS THORACIS	**r. posticus** O: T1 + opposite partner I: rib 3, caudal angle of scapula	**r. posticus** O: dorsal raphe I: vertebral border scapula	**r. posticus** O: ligament + T2-3 I: interscapular ligament	**r. posticus** O: ligament + T2-3 I: interscapular ligament	**r. posticus** O: ligament from opposite partner + T3-4 I: interscapular ligament	**r. posticus** O: ligament + T2-3 I: interscapular ligament
OMOTRANSVERSARIUS	**occipito-scapularis externus** absent	**atlantoscapularis anterior** O: atlas I: metacromion	**atlantoscapularis anterior** absent	**atlantoscapularis anterior** absent	**atlantoscapularis anterior** absent	**atlantoscapularis anterior** absent
OMOTRANSVERSARIUS	**levator scapulae vel claviculae** absent	**atlantoscapularis posterior** absent	**atlantoscapularis posterior** absent	**atlantoscapularis posterior** absent	**atlantoscapularis posterior** absent	**atlantoscapularis posterior** absent
OMOHYOIDEUS	**omo-hyoid** absent	**omohyoideus** absent	**omohyoideus** absent	**omohyoideus** absent		**omohyoideus** absent
SERRATUS VENTRALIS CERVICIS	**levator angulae scapulae** O: C3-6 I: vertebral border scapula	**serratus ventralis cervicis** O: C3-7, rib 1 I: deep surface vertebral border scapula	**serratus ventralis cervicis** O: C3-7 I: deep surface vertebral border scapula	**serratus ventralis cervicis** O: C3-T2 I: deep surface vertebral border scapula	**serratus anterior cervicis** O: C4-T2 I: deep surface caudal angle scapula	**serratus ventralis cervicis** O: C3-T2 I: deep surface vertebral border scapula
SERRATUS VENTRALIS THORACIS	**serratus magnus** O: ribs 1-8 I: vertebral border scapula	**serratus ventralis thoracis** O: ribs 3-10 I: deep surface vertebral border scapula	**serratus ventralis thoracis** O: ribs 3-10 I: deep surface vertebral border scapula	**serratus ventralis thoracis** O: ribs 3-10 I: deep surface vertebral border scapula	**serratus anterior thoracis** O: ribs 3-19 I: vertebral border scapula	**serratus ventralis thoracis** O: ribs 3-10 I: deep surface vertebral border scapula
CLAVODELTOIDEUS	**pectoralis major, clavicular** O: lateral clavicle I: DP ridge	**cleidodeltoideus** O: lateral clavicle I: deltoid fossa H	**cleidodeltoideus** O: lateral clavicle I: deltoid fossa H	**cleidodeltoideus** O: lateral clavicle I: deltoid fossa H	**cleidodeltoideus** O: lateral clavicle I: pectoral ridge	**cleidodeltoideus** O: lateral clavicle I: deltoid fossa H

	Soricomorpha continued					
	Talpidae continued					
	Condylura **Dobson, 1883**	**Condylura Whidden, 2000**	**Parascalops Whidden, 2000**	**Scalopus Whidden, 2000**	**Scapanus Reed, 1951**	**Scapanus Whidden, 2000**
ACROMIODELTOIDEUS	**deltoideus** O: lateral clavicle I: distal GT	**acromiodeltoideus** O: lateral clavicle I: deltoid fossa H	**acromiodeltoideus** O: lateral clavicle I: deltoid fossa H	**acromiodeltoideus** O: lateral clavicle I: deltoid fossa H	**acromiodeltoideus** O: medial clavicle I: pectoral ridge	**acromiodeltoideus** O: lateral clavicle I: deltoid fossa H
SPINODELTOIDEUS		**spinodeltoideus** O: tuber spinae + spine scapula I: deltoid process H	**spinodeltoideus** O: tuber spinae + spine scapula I: deltoid process H	**spinodeltoideus** O: tuber spinae + spine scapula I: deltoid process H	**spinodeltoideus** O: tuber spinae + spine scapula I: deltoid ridge	**spinodeltoideus** O: tuber spinae + spine scapula I: deltoid process H
TERES MINOR	**teres minor** absent				**teres minor** absent	
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: DP ridge	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT
TERES MAJOR	**teres major** O: w SS from glenoid border scapula I: w/ LD process distal to DP ridge	**teres major** O: vertebral border scapula I: teres tubercle H	**teres major** O: teres fossa + vertebral border scapula I: teres tubercle H	**teres major** O: teres fossa + vertebral border scapula I: teres tubercle H	**teres major** O: teres fossa + vertebral border scapula I: w/ LD teres tubercle	**teres major** O: teres fossa + vertebral border scapula I: teres tubercle H
LATISSIMUS DORSI	**latissimus dorsi** O: 3T, all L vertebrae I: w/ TMA process distal to DP ridge	**latissimus dorsi** O: last T vertebrae, fascia lumbar region I: TMA	**latissimus dorsi** O: last T vertebrae, fascia lumbar region I: TMA	**latissimus dorsi** O: last T vertebrae, fascia lumbar region I: TMA	**latissimus dorsi** O: last 4T, first L vertebrae, iliac crest, sacrum I: w/ TMA teres tubercle	**latissimus dorsi** O: last T vertebrae, fascia lumbar region I: TMA
DORSO-EPITROCHLEARIS	**dorso-epitrochlearis** O: TMA + LD I: fascia of forearm	**dorsoepitrochlearis** O: LD I: fascia forearm flexors	**dorsoepitrochlearis** O: LD I: fascia forearm flexors	**dorsoepitrochlearis** O: LD I: fascia forearm flexors	**dorso-epitrochlearis** O: LD I: medial elbow fascia	**dorsoepitrochlearis** O: LD I: fascia forearm flexors
PECTORALIS SUPERFICIALIS "clavicular"						
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis major, anterior** O: sternum I: cranial H	**pectoralis superficialis pars anticus** O: manubrium + ventral raphe I: medial pectoral process H	**pectoralis superficialis pars anticus** O: manubrium + ventral raphe I: medial pectoral process H	**pectoralis superficialis pars anticus** O: manubrium + ventral raphe I: medial pectoral process H	**pectoralis superficialis anticus** O: sternum + ventral raphe I: pectoral process H	**pectoralis superficialis pars anticus** O: manubrium + ventral raphe I: medial pectoral process H

	Soricomorpha continued					
	Talpidae continued					
	Condylura Dobson, 1883	Condylura Whidden, 2000	Parascalops Whidden, 2000	Scalopus Whidden, 2000	Scapanus Reed, 1951	Scapanus Whidden, 2000
PECTORALIS SUPERFICIALIS "deep"	**pectoralis major, posterior sternal** O: sternum I: DP ridge	**pectoralis superficialis pars posticus** O: sternum I: lateral pectoral process	**pectoralis superficialis pars posticus** O: sternum I: lateral pectoral process	**pectoralis superficialis pars posticus** O: sternum I: lateral pectoral process	**pectoralis superficialis posticus** O: manubrium, sternum, ribs 2-7 I: medial pectoral crest	**pectoralis superficialis pars posticus** O: sternum I: lateral pectoral process
PECTORALIS PROFUNDUS	**pectoralis minor** O: manubrium I: LT	**pectoralis profundus** O: manubrium + ribs I: lateral pectoral ridge	**pectoralis profundus** O: manubrium + ribs I: lateral pectoral ridge	**pectoralis profundus** O: manubrium + ribs I: lateral pectoral ridge	**pectoralis profundus** O: manubrium + ribs 1-2 I: lateral pectoral ridge	**pectoralis profundus** O: manubrium + ribs I: lateral pectoral ridge
PECTORALIS ABDOMINALIS	**pectoralis major, separate narrow band** O: external oblique I: w/ PSd	**pectoralis abdominalis** O: rectus abdominalis + external oblique I: pectoral crest H	**pectoralis abdominalis** O: rectus abdominalis + external oblique I: pectoral crest H	**pectoralis abdominalis** absent	**pectoralis abdominalis** O: rectus abdominalis + external oblique I: w/ PSd	**pectoralis abdominalis** O: rectus abdominalis + external oblique I: pectoral crest H
SUBCLAVIUS	**subclavius** O: rib 1 I: clavicle	**subclavius (3 heads)** O: manubrium + rib 1 I: metacromion + clavicle	**subclavius (3 heads)** O: manubrium + rib 1 I: clavicle + acromion	**subclavius (3 heads)** O: manubrium + rib 1 I: clavicle + acromion	**subclavius** O: rib 1 I: clavicle	**subclavius (3 heads)** O: manubrium + rib 1 I: clavicle + acromion
STERNOSCAPULARIS	**sterno-costalis** O: manubrium I: rib 1				**costoscapularis ventralis** O: manubrium I: lateral clavicle	
CORACOBRACHIALIS	**coraco-brachialis** absent	**coracobrachialis** absent	**coracobrachialis** absent	**coracobrachialis** absent	**coracobrachialis** absent	**coracobrachialis** absent
CORACOBRACHIALIS						
BICEPS BRACHII, short head						
BICEPS BRACHII, long head	**biceps** O: glenoid I: medial R	**biceps brachii** O: rim glenoid I: R	**biceps brachii** O: rim glenoid I: R	**biceps brachii** O: rim glenoid I: R	**biceps brachii** O: rim glenoid I: R	**biceps brachii** O: rim glenoid I: R

	Soricomorpha continued					
	Talpidae continued					
	Condylura Dobson, 1883	Condylura Whidden, 2000	Parascalops Whidden, 2000	Scalopus Whidden, 2000	Scapanus Reed, 1951	Scapanus Whidden, 2000
BRACHIALIS	**brachialis anticus** O: caudal + lateral GT I: medial U	**brachialis** O: caudal + lateral H I: U	**brachialis** O: caudal + lateral H I: U	**brachialis** O: caudal + lateral H I: U	**brachialis** O: caudal + lateral H I: U	**brachialis** O: caudal + lateral H I: U
CUBITALIS						
SUPRASPINATUS	**supra-spinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: pit at base GT	**supraspinatus** O: supraspinous fossa I: pit at base GT	**supraspinatus** O: supraspinous fossa I: pit at base GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: pit at base GT
INFRASPINATUS	**infra-spinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT + H head	**infraspinatus** O: infraspinous fossa I: GT + H head	**infraspinatus** O: infraspinous fossa I: GT + H head	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT + H head
TRICEPS BRACHII CAPUT LATERALE	**triceps, external** O: GT I: olecranon w/ TLO	**triceps brachii, caput lateralis** O: lateral GT + caudal H I: lateral olecranon	**triceps brachii, caput lateralis** O: lateral GT + caudal H I: lateral olecranon	**triceps brachii, caput lateralis** O: lateral GT + caudal H I: lateral olecranon	**triceps, superficial lateral** O: lateral H I: lateral olecranon	**triceps brachii, caput lateralis** O: lateral GT + caudal H I: lateral olecranon
TRICEPS BRACHII CAPUT MEDIALE	**triceps, internal** O: cranial + caudal H I: olecranon	**triceps brachii, caput medialis** O: cranial + caudal H I: olecranon (2 parts)	**triceps brachii, caput medialis** O: cranial + caudal H + TMA I: olecranon (2 parts)	**triceps brachii, caput medialis** O: cranial + caudal H + TMA I: olecranon (2 parts)	**triceps, medial** O: teres tubercle + medial H I: medial olecranon	**triceps brachii, caput medialis** O: cranial + caudal H + TMA I: olecranon (2 parts)
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps, scapula** O: caudal border scapula I: olecranon	**triceps brachii, caput longus** O: spine between teres fossa + infraspinous fossa I: olecranon	**triceps brachii, caput longus** O: spine between teres fossa + infraspinous fossa I: olecranon	**triceps brachii, caput longus** O: spine between teres fossa + infraspinous fossa I: olecranon	**triceps, long** O: caudal border scapula I: olecranon	**triceps brachii, caput longus** O: spine between teres fossa + infraspinous fossa I: olecranon
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)	**triceps, fourth head** O: caudal H by GT I: w/ TLA and joint capsule					
TRICEPS BRACHII ACCESSORY						
ANCONEUS	**anconeus externus** O: lateral epicondyle I: lateral U	**anconeus lateralis** O: caudal surface lateral epicondyle I: posterior crest U	**anconeus lateralis** O: caudal surface lateral epicondyle I: posterior crest U	**anconeus lateralis** O: caudal surface lateral epicondyle I: posterior crest U	**anconeus lateralis** O: caudal surface lateral epicondyle I: posterior crest U	**anconeus lateralis** O: caudal surface lateral epicondyle I: posterior crest U
BRACHIORADIALIS	**supinator longus** absent	**brachioradialis** absent	**brachioradialis** absent	**brachioradialis** absent	**brachioradialis** absent	**brachioradialis** absent

	Soricomorpha continued Talpidae continued ***Condylura*** **Dobson, 1883**	**Condylura Whidden, 2000**	**Parascalops Whidden, 2000**	**Scalopus Whidden, 2000**	**Scapanus Reed, 1951**	**Scapanus Whidden, 2000**
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis** O: lateral H proximal to epicondyle I: base MC2 + 3	**ext carpi radialis** O: lateral epicondyle I: medial MC3	**ext carpi radialis** O: lateral epicondyle I: medial MC3	**ext carpi radialis** O: lateral epicondyle I: medial MC3	**ext carpi radialis** O: lateral epicondyle I: MC2 + 3	**ext carpi radialis** O: lateral epicondyle I: medial MC3
EXT CARPI RADIALIS, brevis (MC3)						
EXT DIGITORUM COMMUNIS	**ext communis digitorum** O: w/ EDL lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle (3 heads) I: digits 2, 3, 3, 4, 4, 5	**ext digitorum communis** O: lateral epicondyle (3 heads) I: digits 2, 3, 3, 4, 4, 5	**ext digitorum communis** O: lateral epicondyle (3 heads) I: digits 2, 3, 3, 4, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 4, 5	**ext digitorum communis** O: lateral epicondyle (3 heads) I: digits 2, 3, 3, 4, 4, 5
EXT DIGITORUM LATERALIS	**ext minimi digiti** O: w/ EDC lateral epicondyle I: digits 4 + 5	**ext digiti quinti proprius** O: lateral epicondyle I: digits 4, 5	**ext digiti quinti proprius** O: olecranon + lateral epicondyle I: digit 5	**ext digiti quinti proprius** O: olecranon + lateral epicondyle I: digit 5	**ext digiti quinti proprius** O: lateral epicondyle I: digit 5 * 2 heads	**ext digiti quinti proprius** O: olecranon + lateral epicondyle I: digit 5
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + U I: ulnar sesamoid	**ext carpi ulnaris** O: lateral epicondyle I: lateral digit 4	**ext carpi ulnaris** O: lateral epicondyle I: lateral digit 4	**ext carpi ulnaris** O: lateral epicondyle I: lateral digit 4	**ext carpi ulnaris** O: lateral epicondyle I: lateral digit 4
SUPINATOR	**supinator brevis** absent	**supinator** O: lateral epicondyle I: medial proximal R	**supinator** O: lateral epicondyle I: medial proximal R	**supinator** O: lateral epicondyle I: medial proximal R	**supinator** O: lateral epicondyle I: proximal R	**supinator** O: lateral epicondyle I: medial proximal R
ABD POLLICIS LONGUS	**ext ossis metacarpi pollicis** O: proximal lateral U + R I: MC1	**abd pollicis longus** O: U + R I: digit 1	**abd pollicis longus** O: U + R I: MC1	**abd pollicis longus** O: U + R I: MC1	**abd pollicis longus** O: lateral olecranon + R I: base MC1	**abd pollicis longus** O: U + R I: MC1
EXT DIGITORUM PROFUNDUS	**ext secundi internodii pollicis et ext indicis** O: proximal lateral U + R I: digits 1, 2	**ext indicis et pollicis longus** O: lateral olecranon I: digits 1, 2	**ext indicis et pollicis longus** O: lateral olecranon I: digits 1, 2	**ext indicis et pollicis longus** O: lateral olecranon I: digits 1, 2	**ext indicis et pollicis longus** O: lateral olecranon I: digit 1	**ext indicis et pollicis longus** O: lateral olecranon I: digits 1, 2
PRONATOR TERES	**pronator radii teres** O: medial epicondyle I: middle U, 2 parts	**pronator radii teres** O: medial epicondyle I: R	**pronator radii teres** O: medial epicondyle I: R	**pronator radii teres** O: medial epicondyle I: R	**pronator radii teres** O: medial epicondyle I: middle cranial R	**pronator radii teres** O: medial epicondyle I: R

	Soricomorpha continued					
	Talpidae continued					
	Condylura Dobson, 1883	Condylura Whidden, 2000	Parascalops Whidden, 2000	Scalopus Whidden, 2000	Scapanus Reed, 1951	Scapanus Whidden, 2000
FLX CARPI RADIALIS		**flx carpi radialis** O: near entepicondylar foramen I: MC3	**flx carpi radialis** O: near entepicondylar foramen I: MC2 + 3	**flx carpi radialis** O: near entepicondylar foramen I: MC2 + 3	**flx carpi radialis** O: medial epicondyle I: between base MC2 + 3	**flx carpi radialis** O: near entepicondylar foramen I: MC2 + 3
PALMARIS LONGUS	**palmaris longus** O: medial epicondyle w/ FCU, 2 parts I: falciform + palmar fascia + digit 5	**palmaris longus** O: medial epicondyle I: falciform + digit 5	**palmaris longus** O: medial epicondyle I: falciform + digit 5	**palmaris longus** O: medial epicondyle I: falciform + digit 5	**palmaris longus** O: tip medial epicondyle I: palmar fascia + falciform + digit 2	**palmaris longus** O: medial epicondyle I: falciform + digit 5
FLX DIGITORUM SUPERFICIALIS	**flx digitorum sublimis** O: medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum superficialis** O: medial epicondyle (3 heads) I: digits 2f, 3f, 4f	**flx digitorum superficialis** O: medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum superficialis** O: medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum sublimis** O: medial epicondyle I: fascia of palm	**flx digitorum superficialis** O: medial epicondyle I: digits 2f, 3f, 4f
INTERFLEXORII						
FLX DIGITORUM PROFUNDUS,	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**
epicondylar		= flexor ligament	= flexor ligament	= flexor ligament		= flexor ligament
epicondylar (FDPe)	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: caudal medial epicondyle	O: medial epicondyle
epicondylar (FDPd)	O: R I: pollex	O: U	O: U	O: U	O: U	O: U
ulnar	O: U	O: U	O: U	O: U	O: U	O: U
radial	O: R I: deep surface FDPe *I: digits 1, 2, 3, 4, 5			-	 *I: digits 1, 2, 3, 4, 5	-
LUMBRICALES						
FLX CARPI ULNARIS,		**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**
epitrochlear belly		O: medial epicondyle	-	-	-	-
ulnar belly		O: olecranon I: pisiform	O: olecranon I: pisiform	O: olecranon I: pisiform	O: olecranon I: pisiform	O: olecranon I: pisiform

	Soricomorpha continued Talpidae continued					
	Condylura **Dobson, 1883**	**Condylura Whidden, 2000**	**Parascalops Whidden, 2000**	**Scalopus Whidden, 2000**	**Scapanus Reed, 1951**	**Scapanus Whidden, 2000**
EPITROCHLEO-ANCONEUS	**anconeus internus** O: near supracondylar foramen I: medial olecranon	**epitrochleo-anconeus** O: medial epicondyle I: olecranon	**epitrochleo-anconeus** O: medial epicondyle + caudal H (2 heads) I: olecranon	**epitrochleo-anconeus** O: medial epicondyle + caudal H (2 heads) I: olecranon	**epitrochleo-anconeus** O: medial epicondyle I: olecranon	**epitrochleo-anconeus** O: medial epicondyle + caudal H (2 heads) I: olecranon
PRONATOR QUADRATUS		**pronator quadratus** absent	**pronator quadratus** absent	**pronator quadratus** absent	**pronator quadratus** absent	**pronator quadratus** absent
PALMARIS BREVIS						
FLX DIGITORUM BREVES MANUS		**flx brevis digitorum manus** absent	**flx brevis digitorum manus** absent	**flx brevis digitorum manus** absent		**flx brevis digitorum manus** absent
ABD DIGITI MINIMI		**abd digiti quinti** O: pisiform I: sesamoid at MCPj5	**abd digiti quinti** O: pisiform I: sesamoid at MCPj5	**abd digiti quinti** absent		**abd digiti quinti** O: pisiform I: sesamoid at MCPj5
ABD POLLICIS BREVIS		**abd pollicis brevis** O: radiale I: sesamoid at MCPj1	**abd pollicis brevis** O: radiale I: sesamoid at MCPj1	**abd pollicis brevis** absent		**abd pollicis brevis** O: radiale I: sesamoid at MCPj1
CONTRAHENTES						
FLEXOR BREVES PROFUNDUS		**flexores breves** 0	**flexores breves**	**flexores breves** 0	**flexores breves** 1	**flexores breves** 0
INTERMETACARPALES					**interossei dorsales** absent	
? Unknown homology					**costoscapularis dosralis** O: manubrium	
RADIAL SESAMOID "PRE-POLLUX"	present					
ULNAR SESAMOID						
CARPAL VIBRISSAE						

	Megachiroptera		Microchiroptera					
	Pteropodidae		Molossidae	Mormoopidae	Phyllostomidae		Vespertilionidae	
	Pteropus **Humphry, 1869**	*Rousettus* **Norberg, 1972**	*Eumops* **Vaughan, 1959**	*Mormoops* **Vaughan & Bateman, 1970**	*Desmodus* **Altenbach, 1979**	*Macrotus* **Vaughan, 1959**	*Antrozous* **Hermanson & Altenbach, 1983**	*Myotis* **Vaughan, 1959**
PANNICULUS CARNOSUS		**bicipito-plagiopatagialis** O: thigh I: CB + plagiopatagium	**coraco-cutaneus** O: plagiopatagium I: distal medial ridge H					
STERNO-FACIALIS								
STERNOMASTOIDEUS								
CLEIDOMASTOIDEUS								
CLAVOTRAPEZIUS	**trapezius occipital** absent	**clavotrapezius** O: T1-3 I: acromioclavicular ligament, AD, CD			**clavotrapezius** O: T1, rib 1 I: clavicle		**clavotrapezius** fused w/ AT	
CEPHALOHUMERALIS								
ACROMIOTRAPEZIUS	**trapezius** I: lateral clavicle + acromion	**acromiotrapezius** O: T4-12 I: acromion, dorsal scapular ligament	**acromiotrapezius & clavotrapezius** O: C7-T5 I: medial clavicle, acromion, spine scapula		**acromiotrapezius** O: T1-5 I: acromion + spine scapula + AD	**acromiotrapezius & clavotrapezius** O: C7-T5 I: medial clavicle, acromion, spine scapula	**acromiotrapezius** O: T1-7 I: clavicle, acromion, dorsal scapular ligament	**acromiotrapezius & clavotrapezius** O: C7-T5 I: medial clavicle, acromion, spine scapula
OCCIPITO-POLLICALIS		**occipito-pollicalis** O: lambdoidal crest I: dactylopatagium brevis	**occipito-pollicalis** O: lambdoidal crest I: MC2		**occipito-pollicalis** O: cranium I: propatagium near R	**occipito-pollicalis** O: lambdoidal crest I: MC2		**occipito-pollicalis** O: lambdoidal crest I: MC2
SPINOTRAPEZIUS			**spinotrapezius** O: T8-13 I: spine scapula		**spinotrapezius** O: T8-L2 I: spine scapula	**spinotrapezius** O: T10-13 I: vertebral border scapula	**spinotrapezius** O: T7-11 I: vertebral border scapula	**spinotrapezius** O: T7-10 I: spine scapula
RHOMBOIDEUS CAPITIS								
RHOMBOIDEUS CERVICIS								
RHOMBOIDEUS THORACIS	**rhomboideus** O: proximal T vertebrae I: scapula	**rhomboideus** O: T1-7 I: vertebral border scapula	**rhomboideus** O: T1-7 I: vertebral border scapula		**rhomboideus** O: T1-6 I: vertebral border scapula	**rhomboideus** O: T1-6 I: vertebral border scapula	**rhomboideus** O: T1-7 I: vertebral border scapula	**rhomboideus** O: T1-5 I: vertebral border scapula

	Megachiroptera		Microchiroptera					
	Pteropodidae		Molossidae	Mormoopidae	Phyllostomidae		Vespertilionidae	
	Pteropus **Humphry, 1869**	*Rousettus* **Norberg, 1972**	*Eumops* **Vaughan, 1959**	*Mormoops* **Vaughan & Bateman, 1970**	*Desmodus* **Altenbach, 1979**	*Macrotus* **Vaughan, 1959**	*Antrozous* **Hermanson & Altenbach, 1983**	*Myotis* **Vaughan, 1959**
OMOTRANSVERSARIUS "metacromion"	**cervico-humeral** O: C2-3 I: lateral clavicle	**omocervicalis** O: atlas I: lateral clavicle	**omocervicalis** O: atlas I: acromion		**omocervicalis** O: atlas I: clavicle	**omocervicalis** O: atlas I: middle clavicle	**omocervicalis** O: axis I: acromion	**omocervicalis** O: atlas I: acromion
OMOTRANSVERSARIUS								
OMOHYOIDEUS								
SERRATUS VENTRALIS CERVICIS	**levator scapulae** O: C vertebrae I: near cranial angle scapula	**levator scapulae** O: C3-7 I: vertebral border scapula	**levator scapulae** O: C4-7 I: vertebral border scapula		**levator scapulae** O: C4-7 I: vertebral border scapula	**levator scapulae** O: C4-6 I: vertebral border scapula	**levator scapulae** O: C3-7 I: vertebral border scapula	**levator scapulae** O: C3-6 I: vertebral border scapula
SERRATUS VENTRALIS THORACIS "anterior"	**serratus magnus anticus** O: ribs 1-2 I: cranial angle scapula	**serratus anterior anterior division** O: ribs 1-2 I: vertebral border scapula	**serratus anterior anterior division** O: ribs 1-4 I: cranial angle scapula		**serratus anterior, anterior division** O: ribs 1, 6, 7 I: vertebral border scapula	**serratus anterior** O: rib 1 I: cranial angle scapula	**serratus anterior anterior division** O: ribs 1-4 I: caudal angle + border scapula	**serratus anterior** O: ribs 1-5 I: cranial angle scapula
SERRATUS VENTRALIS THORACIS "posterior"	**serratus magnus lower portion** O: ribs 1-8 I: caudal border scapula	**serratus anterior posterior division** O: ribs 1-9 I: caudal border scapula	**serratus anterior posterior division** O: ribs 1-8 I: caudal border scapula		**serratus anterior, posterior division** O: ribs 1-8 I: caudal border scapula	**serratus anterior posterior division** O: ribs 2-10 I: caudal border scapula	**serratus anterior posterior division** O: ribs 1-8 I: caudal angle + border scapula	**serratus anterior posterior division** O: ribs 1-9 I: caudal border scapula
CLAVODELTOIDEUS	**deltoid, clavicular portion** O: lateral clavicle I: bicipital ridge H	**clavodeltoideus** O: lateral clavicle I: proximal pectoral ridge H	**clavodeltoideus** O: lateral clavicle I: proximal pectoral ridge H		**clavodeltoideus (2 bellies)** O: lateral clavicle I: proximal pectoral ridge H + GT	**clavodeltoideus** O: lateral clavicle I: proximal pectoral ridge H	**clavodeltoideus** O: lateral clavicle I: proximal pectoral ridge H	**clavodeltoideus** O: lateral clavicle I: proximal pectoral ridge H + GT
ACROMIODELTOIDEUS	**deltoid,acromial portion** O: acromion I: bicipital ridge H	**acromiodeltoideus** O: acromion + dorsal scapula ligament I: pectoral ridge H	**acromiodeltoideus** O: acromion + spine scapula I: pectoral ridge H		**acromiodeltoideus** O: acromion + spine scapula I: pectoral ridge H	**acromiodeltoideus** O: acromion + spine scapula I: pectoral ridge H	**acromiodeltoideus** O: acromion + dorsal scapular ligament I: pectoral ridge H	**acromiodeltoideus** O: acromion + spine scapula I: distal pectoral ridge H

	Megachiroptera		Microchiroptera					
	Pteropodidae		Molossidae	Mormoopidae	Phyllostomidae		Vespertilionidae	
	Pteropus **Humphry, 1869**	*Rousettus* **Norberg, 1972**	*Eumops* **Vaughan, 1959**	*Mormoops* **Vaughan & Bateman, 1970**	*Desmodus* **Altenbach, 1979**	*Macrotus* **Vaughan, 1959**	*Antrozous* **Hermanson & Altenbach, 1983**	*Myotis* **Vaughan, 1959**
SPINODELTOIDEUS		**spinodeltoideus** O: spine scapula I: Gt + pectoral ridge H	**spinodeltoideus** O: vertebral border scapula I: pectoral ridge H w/ AD		**spinodeltoideus** O: spine scapula + vertebral border scapula I: pectoral ridge H	**spinodeltoideus (divided)** O: vertebral border scapula I: pectoral ridge H w/ AD	**spinodeltoideus** O: spine scapula + caudal angle scapula I: pectoral ridge H	**spinodeltoideus** O: spine scapula I: pectoral ridge H w/ AD
TERES MINOR	**teres minor** O: caudal border scapula I: lateral GT	**teres minor** O: caudal border scapula I: lateral GT	**teres minor** O: caudal border scapula I: distal GT		**teres minor** O: caudal border scapula near glenoid I: distal GT	**teres minor** O: caudal border scapula I: distal GT	**teres minor** O: caudal border scapula + IN I: GT	**teres minor** O: caudal border scapula I: distal GT
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT		**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT
TERES MAJOR	**teres major** "as usual" I: medial bicipital ridge H	**teres major** O: caudal border scapula I: LT + H	**teres major** O: caudo-lateral facet scapula I: distal medial ridge H w/ LD		**teres major** O: vertebral + caudal borders scapula I: H w/ LD	**teres major** O: caudo-lateral facet scapula I: distal medial ridge H w/ LD	**teres major** O: caudal border scapula I: medial ridge H	**teres major** O: caudo-lateral facet scapula I: distal medial ridge H w/ LD
LATISSIMUS DORSI "superficial" "deep"	**latissimus dorsi** O: caudal T-L vertebrae I: LT	**latissimus dorsi** O: T10-L2, lumbodorsal fascia I: LT + H	**latissimus dorsi** O: T10-13, lumbodorsal fascia I: distal medial ridge H w/ TMA		**latissimus dorsi** O: T9-L3 I: H w/ TMA	**latissimus dorsi** O: T10-12, lumbodorsal fascia I: distal medial ridge H w/ TMA	**latissimus dorsi** O: T11-13 I: medial ridge H	**latissimus dorsi** O: T9-11, lumbodorsal fascia I: distal medial ridge H w/ TMA
DORSO-EPITROCHLEARIS								
PECTORALIS SUPERFICIALIS "clavicular"								
PECTORALIS SUPERFICIALIS "superficial"	**pectoral, clavicular** O: medial clavicle I: lateral bicipital groove H	**pectoralis, anterior division** O: clavicle I: proximal pectoral ridge H	**pectoralis, anterior division** O: clavicle I: pectoral ridge H		**pectoralis, anterior division** O: clavicle I: pectoral ridge H	**pectoralis, anterior division** O: clavicle I: pectoral ridge H	**pectoralis, anterior division** O: manubrium + medial clavicle I: pectoral ridge H	**pectoralis, anterior division** O: clavicle + manubrium I: pectoral ridge H

	Megachiroptera		Microchiroptera					
	Pteropodidae		Molossidae	Mormoopidae	Phyllostomidae		Vespertilionidae	
	Pteropus **Humphry, 1869**	*Rousettus* **Norberg, 1972**	*Eumops* **Vaughan, 1959**	*Mormoops* **Vaughan & Bateman, 1970**	*Desmodus* **Altenbach, 1979**	*Macrotus* **Vaughan, 1959**	*Antrozous* **Hermanson & Altenbach, 1983**	*Myotis* **Vaughan, 1959**
PECTORALIS SUPERFICIALIS "deep"	**pectoral, sternal** O: maubrium + sternum I: lateral bicipital groove H	**pectoralis, posterior division** O: maubrium + sternum + ribs 2-6 I: pectoral ridge H	**pectoralis, posterior division** O: maubrium + sternum I: pectoral ridge H		**pectoralis, posterior division** O: maubrium + sternum I: proximal pectoral ridge H	**pectoralis, posterior division** O: maubrium + sternum + abominal fascia I: pectoral ridge H	**pectoralis, posterior division** O: manubrium + sternum I: pectoral ridge H	**pectoralis, posterior division** O: maubrium + sternum I: pectoral ridge H
PECTORALIS PROFUNDUS								
PECTORALIS ABDOMINALIS	**pectoral, abdominal portion** O: pubes w/ rectus abdominis I: lateral bicipital groove H	**pectoralis abdominalis** O: abdominal fascia I: pectoral ridge H	**pectoralis abdominalis** O: xiphisternum I: middle pectoral ridge H		**pectoralis abdominalis** O: xiphisternum I: pectoral ridge H	**pectoralis abdominalis** O: xiphisternum I: GT + middle pectoral ridge H	**pectoralis abdominalis** O: abdomen I: medial pectoral ridge H	**pectoralis abdominalis** O: xiphisternum I: middle pectoral ridge H
SUBCLAVIUS	**subclavius** O: rib 1 I: clavicle	**subclavius** O: rib 1 I: clavicle	**subclavius** O: rib 1 I: clavicle		**subclavius** O: rib 1 I: clavicle	**subclavius** O: rib 1 I: clavicle	**subclavius** O: rib 1 I: lateral clavicle	**subclavius** O: rib 1 I: clavicle
STERNOSCAPULARIS								
CORACOBRACHIALIS	**coraco-brachialis** O: coracoid + BB I: medial H	**coraco-brachialis** O: coracoid I: H	**coracobrachialis** absent	**coracobrachialis** O: coracoid I: middle cranial H	**coracobrachialis** O: coracoid I: cranio-medial H	**coracobrachialis** O: coracoid I: medial H	**coracobrachialis** O: coracoid I: caudo-medial H	**coracobrachialis** O: coracoid I: medial H
CORACOBRACHIALIS								
BICEPS BRACHII, short head	**biceps** O: coracoid I: medial R	**biceps brachii, coracoid head** O: coracoid I: slit on cranial R	**biceps brachii** O: coracoid + glenoid I: slit in cranio-medial R	**biceps brachii** O: coracoid + glenoid I: groove R distal to head	**biceps brachii** O: coracoid + glenoid I: flexor fossa in R	**biceps brachii** O: coracoid + glenoid I: slit in cranio-medial R	**biceps brachii, coracoid head** O: coracoid I: medial flexor groove R	**biceps brachii** O: coracoid + glenoid I: slit in cranio-medial R
BICEPS BRACHII, long head	**biceps** O: coracoid I: medial R	**biceps brachii, glenoid head** O: coracoid I: cranial R					**biceps brachii, glenoid head** O: lateral coracoid process I: flexor groove R	

	Megachiroptera		Microchiroptera					
	Pteropodidae		Molossidae	Mormoopidae	Phyllostomidae		Vespertilionidae	
	Pteropus **Humphry, 1869**	*Rousettus* **Norberg, 1972**	*Eumops* **Vaughan, 1959**	*Mormoops* **Vaughan & Bateman, 1970**	*Desmodus* **Altenbach, 1979**	*Macrotus* **Vaughan, 1959**	*Antrozous* **Hermanson & Altenbach, 1983**	*Myotis* **Vaughan, 1959**
BRACHIALIS	**brachialis anticus** O: medial H I: U	**brachialis** O: distal cranial H I: cranial U	**brachialis** O: distal cranial H I: slit in cranio-medial R	**brachialis** absent	**brachialis** O: distal cranial H I: flexor fossa in R	**brachialis** O: distal cranial H I: slit in cranio-medial R	**brachialis** O: middle cranial H I: flexor fossa R	**brachialis** O: distal cranial H I: slit in cranio-medial R
CUBITALIS								
SUPRASPINATUS	**supra-spinatus** "as usual"	**supraspinatus** O: supraspinous fossa I: medial GT	**supraspinatus** O: supraspinous fossa I: GT		**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT
INFRASPINATUS	**infra-spinatus**	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: distal GT		**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: distal GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: distal GT
TRICEPS BRACHII CAPUT LATERALE	**triceps, remainder** O: caudal H I: sesamoid at olecranon	**triceps brachii lateral head** O: caudal H I: olecranon	**triceps brachii caput lateralis** O: caudo-lateral GT I: olecranon	**triceps brachii caput lateralis** O: distal GT + LT + proximal caudal H I: elbow sesamoid + olecranon	**triceps brachii caput lateralis** O: caudal H I: sesamoid at olecranon	**triceps brachii caput lateralis** O: caudo-lateral GT I: olecranon	**triceps brachii lateral head** O: caudal pectoral ridge H I: connective tissue at olecranon	**triceps brachii caput lateralis** O: caudo-lateral GT I: olecranon
TRICEPS BRACHII CAPUT MEDIALE		**triceps brachii medial head** O: caudal H I: olecranon	**triceps brachii caput medialis** O: caudal H I: olecranon	**triceps brachii caput medialis** absent	**triceps brachii caput medialis** O: caudal H I: sesamoid at olecranon	**triceps brachii caput medialis** O: caudal H I: olecranon	**triceps brachii medial head** O: distal caudal H I: olecranon	**triceps brachii caput medialis** O: caudal H I: olecranon
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps, long head** O: near glenoid I: sesamoid at olecranon	**triceps brachii long head** O: caudal border scapula I: olecranon	**triceps brachii caput longus** O: caudal border scapula I: olecranon	**triceps brachii caput longus, dorsal portion** O: tubercle on caudal border scapula I: elbow sesamoid	**triceps brachii caput longus** O: tubercles at caudal border scapula I: sesamoid at olecranon	**triceps brachii caput longus** O: caudal border scapula I: olecranon	**triceps brachii long head** O: infraglenoid tubercle I: olecranon w/ TLO	**triceps brachii caput longus** O: caudal border scapula I: olecranon

	Megachiroptera		Microchiroptera					
	Pteropodidae		Molossidae	Mormoopidae	Phyllostomidae		Vespertilionidae	
	Pteropus **Humphry, 1869**	*Rousettus* **Norberg, 1972**	*Eumops* **Vaughan, 1959**	*Mormoops* **Vaughan & Bateman, 1970**	*Desmodus* **Altenbach, 1979**	*Macrotus* **Vaughan, 1959**	*Antrozous* **Hermanson & Altenbach, 1983**	*Myotis* **Vaughan, 1959**
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)		**triceps brachii long head**		**triceps brachii caput longus, ventral portion** O: caudal border scapula I: elbow sesamoid			**triceps brachii long head** O: infraglenoid tubercle I: olecranon w/ TLO	
TRICEPS BRACHII ACCESSORY								
ANCONEUS								
BRACHIORADIALIS	**supinator longus** O: distal lateral H I: lateral R	**brachio-radialis** O: distal H I: proximal cranial R		**brachioradialis** O: caudal ridge H I: cranial R				
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis longior** O: lateral epicondyle w/ ECRb I: base MC2	**ext carpi radialis longus** O: lateral epicondyle I: base MC2	**ext carpi radialis longus** O: lateral supracondylar ridge H I: base MC1 + 2	**ext carpi radialis longus** O: lateral supracondylar ridge H I: sesamoid between trapezium + base MC2	**ext carpi radialis longus** O: lateral epicondyle I: base MC1 + 2	**ext carpi radialis longus** O: lateral epicondyle I: base MC1 + 2		**ext carpi radialis longus** O: lateral epicondyle I: base MC1 + 2
EXT CARPI RADIALIS, brevis (MC3)	**ext carpi radialis brevior** O: lateral epicondyle w/ ECRl I: base MC3	**ext carpi radialis brevis** O: lateral epicondyle I: base MC3 + 4 + 5	**ext carpi radialis brevis** O: sesamoid at lateral supracondylar ridge H I: sesamoid at MC3	**ext carpi radialis brevis** O: lateral supracondylar ridge H I: sesamoid between base MC2 + 3	**ext carpi radialis brevis** O: lateral epicondyle I: base MC3 + trapezium	**ext carpi radialis brevis** O: lateral epicondyle I: sesamoid at MC3		**ext carpi radialis brevis** O: lateral epicondyle I: sesamoid at MC3
EXT DIGITORUM COMMUNIS	**ext digitorum** O: lateral epicondyle + olecranon I: digits 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 3, 4, 5	**ext digitorum communis** O: proximal caudal R + U // caudal R I: digits 3 // digits 4, MCPj5	**ext digitorum communis** O: lateral epicondyle I: digits 3, 4, 5	**ext digitorum communis** O: lateral epicondyle + R + U I: MC2, digits 3, 4, 5		**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5

	Megachiroptera		Microchiroptera					
	Pteropodidae		Molossidae	Mormoopidae	Phyllostomidae		Vespertilionidae	
	Pteropus **Humphry, 1869**	*Rousettus* **Norberg, 1972**	*Eumops* **Vaughan, 1959**	*Mormoops* **Vaughan & Bateman, 1970**	*Desmodus* **Altenbach, 1979**	*Macrotus* **Vaughan, 1959**	*Antrozous* **Hermanson & Altenbach, 1983**	*Myotis* **Vaughan, 1959**
EXT DIGITORUM LATERALIS			**ext digiti quinti proprius** absent	**ext digiti quinti proprius** O: lateral epicondyle I: digit 5	**ext digiti quinti proprius** O: lateral epicondyle I: digit 5	**ext digiti quinti proprius** O: U + lateral epicondyle I: digit 5		**ext digiti quinti proprius** O: U + EDC I: digit 5
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral U I: MC5	**ext carpi ulnaris** O: proximal U I: MC5	**ext carpi ulnaris** O: R + U I: base MC3	**ext carpi ulnaris** O: caudal R + U I: base MC5	**ext carpi ulnaris** O: U I: base MC5	**ext carpi ulnaris** O: R + U I: base MC5		**ext carpi ulnaris** O: R + U I: base MC3
SUPINATOR	**supinator brevis** O: lateral epicondyle I: R	**supinator** O: sesamoid at lateral epicondyle I: cranial R	**supinator** O: lateral epicondyle I: cranio-lateral R	**supinator** O: sesamoid at lateral epicondyle I: proximal 1/5 cranial R	**supinator** O: sesamoid at lateral epicondyle I: cranial R	**supinator** O: lateral epicondyle I: cranio-lateral R		**supinator** O: lateral epicondyle I: cranio-lateral R
ABD POLLICIS LONGUS	**ext primus (ossis metacarpi) pollicis** O: proximal R + U I: sesamoid at magnum	**abd pollicis longus** O: R + U I: scaphoid	**abd pollicis longus** O: interosseus membrane + R I: scaphoid	**abd pollicis longus** O: middle R + U I: sesamoid at scapholunar	**abd pollicis longus** O: interosseus membrane + R I: scaphoid	**abd pollicis longus** O: interosseus membrane + R I: scaphoid		**abd pollicis longus** O: interosseus membrane + R I: scaphoid
EXT DIGITORUM PROFUNDUS	**ext indicis** O: deep to EPB I: digit 2	**ext indicis** O: U I: MC1, digit 2	**ext indicis** O: U I: base MC2	**ext indicis** O: caudal R + U I: sesamoid at MC4	**ext indicis** O: R + U I: MC1, sesamoid at MC2, MC3 + MC4	**ext indicis** O: U I: base MC2		**ext indicis** O: U I: base MC2
EXT POLLICIS LONGUS								
EXT POLLICIS BREVIS	**secundus** O: proximal R + U I: digit 1	**ext pollicis brevis** O: U I: digit 1	**ext pollicis brevis** O: U I: digit 1	**ext pollicis brevis** O: U I: sesamoid at MC1	**ext pollicis brevis** O: U I: digit 1	**ext pollicis brevis** O: U I: digit 1		**ext pollicis brevis** O: U I: digit 1
EXT BREVIS DIGITORUM								
PRONATOR TERES	**pronator teres** O: medial epicondyle I: proximal 1/3 R	**pronator teres** O: medial epicondyle I: proximal R	**pronator teres** O: medial epicondyle I: proximal 1/8 medial R	**pronator teres** O: distal spinous process H I: proximal cranial R	**pronator teres** O: medial epicondyle I: R	**pronator teres** O: medial epicondyle I: proximal 1/3 medial R		**pronator teres** O: medial epicondyle I: proximal 1/3 medial R

	Megachiroptera		Microchiroptera					
	Pteropodidae		Molossidae	Mormoopidae	Phyllostomidae		Vespertilionidae	
	Pteropus **Humphry, 1869**	*Rousettus* **Norberg, 1972**	*Eumops* **Vaughan, 1959**	*Mormoops* **Vaughan & Bateman, 1970**	*Desmodus* **Altenbach, 1979**	*Macrotus* **Vaughan, 1959**	*Antrozous* **Hermanson & Altenbach, 1983**	*Myotis* **Vaughan, 1959**
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: base MC2	**flx carpi radialis** O: medial epicondyle + PT I: base MC2	**flx carpi radialis** O: PT I: base MC1	**flx carpi radialis** O:PT or distal spinous process H I: base MC2	**flx carpi radialis** O: PT I: base MC2	**flx carpi radialis** O: PT I: base MC3		**flx carpi radialis** O: PT I: lost at carpus
PALMARIS LONGUS	**flx digitorum sublimis** O: medial epicondyle + proximal R I: sesamoid at pollex + digit 2	**palmaris longus** O: medial epicondyle I: sesamoid at MCPj 1, digit 2, MC5	**palmaris longus** O: medial epicondyle I: aponeurosis, digits 1 + 5	**palmaris longus** O: distal spinous process H I: base MC2	**palmaris longus** O: FDP + medial epicondyle I: aponeurosis digit 1, MC2 + 3 + V	**palmaris longus** O: FDP + medial epicondyle I: aponeurosis, digits 1 + 3 + 5		**palmaris longus** absent
FLX DIGITORUM SUPERFICIALIS								
INTERFLEXORII								
FLX DIGITORUM PROFUNDUS, epicondylar	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus (m)**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus (m)**		**flx digitorum profundus (m)**
epicondylar (FDPe)	O: medial epicondyle w/ FDS	O: medial epicondyle + PT		O: distal spinous process H	O: tip medial epicondyle	O: distal medial epicondyle		O: medial epicondyle
epicondylar (FDPd)								
ulnar	O: cranial U		O: cranio-medial U		O: U			
radial	O: R		O: proximal R		O: caudal R			O: proximal R
	*I: digits 1, 2, 3	*I: digits 1, 2, 3	*I: digits 1, 5	I: digits 1, 3, 4, 5	*I: digits 1, 3	*I: digits 1, 3		*I: digits 1, 3, 4
LUMBRICALES	**like lumbricales** O: FDP I: digits 2, 3							
FLX CARPI ULNARIS,	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**		**flx carpi ulnaris**
epitrochlear belly	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: distal spinous process H				O: medial epicondyle
ulnar belly	O: U	O: proximal U			O: medial U	O: medial U		
	I: magnum	I: pisiform	I: pisiform	I: pisiform	I: pisiform	I: pisiform		I: pisiform

	Megachiroptera		Microchiroptera					
	Pteropodidae		Molossidae	Mormoopidae	Phyllostomidae		Vespertilionidae	
	Pteropus **Humphry, 1869**	*Rousettus* **Norberg, 1972**	*Eumops* **Vaughan, 1959**	*Mormoops* **Vaughan & Bateman, 1970**	*Desmodus* **Altenbach, 1979**	*Macrotus* **Vaughan, 1959**	*Antrozous* **Hermanson & Altenbach, 1983**	*Myotis* **Vaughan, 1959**
EPITROCHLEO-ANCONEUS								
PRONATOR QUADRATUS								
PALMARIS BREVIS								
FLX DIGIOTRUM BREVIS MANUS								
ABD DIGITI MINIMI	**interosseal abductor** I: MC5	**abd digiti quinti** O: scaphoid I: MCPj 5	**abd digiti quinti** O: scaphoid I: MCPj 5	**abd digiti quinti** O: scapholunar sesamoid I: sesamoid base digit 5	**abd digiti quinti** O: scaphoid I: MC5	**abd digiti quinti** O: radial sesamoid I: MCPj 5		**abd digiti quinti** O: pisiform I: MCPj 5
ABD POLLICIS BREVIS		**abd pollicis brevis** O: base MC1 I: sesamoid at MC1	**abd pollicis brevis** O: trapezium I: MCPj 1	**abd pollicis brevis** O: scapholunar + MC1 I: MCPj 1	**abd pollicis brevis** w/ APL	**abd pollicis brevis** O: trapezium I: MCPj 1		**abd pollicis brevis** O: trapezium I: MCPj 1
CONTRAHENTES		**add pollicis** I: digit 1	**abd pollicis, add digiti secundi, add digiti quinti** O: MC2 I: digit 1, trapezium, MC5	**add pollicis** I: MCPj 1L	**add pollicis** O: MC2 I: digit 1	**abd pollicis, add digiti secundi, add digiti quinti** absent		**abd pollicis, add digiti secundi** O: MC2 I: digit 1, trapezium
FLEXOR BREVES PROFUNDUS	**interossei** 10	**flx pollicis brevis, interossei** 8	**flx pollicis brevis, interossei** 5	**flx pollicis brevis, opp digiti quinti, interossei** 6	**flx pollicis brevis, interossei** 6	**flx pollicis brevis, interossei** 5		**flx pollicis brevis, interossei** 5
INTERMETACARPALES			**interosseus dorsales** 1		**interosseus dorsales** 1	**interosseus dorsales** absent		**interosseus dorsales** absent
? Unknown homology		**opp digiti quinti** O: pisiform I: MCPj 5	**opp digiti quinti** O: pisiform I: MCPj 5		**opp digiti quinti** O: pisiform I: MC5	**opp digiti quinti** O: pisiform I: MCPj 5		**opp digiti quinti** O: pisiform I: MCPj 5
RADIAL SESAMOID "PRE-POLLUX"								
ULNAR SESAMOID								
CARPAL VIBRISSAE								

	Rhinocerotidae		Equidae		Tapiridae			
	Dicerorhinus **Beddard & Treves, 1889**	***Rhinoceros*** **Windle & Parsons, 1901**	***Equus*** **Sisson, 1914**	***Equus*** **Windle & Parsons, 1901**	***Tapirus*** **Bressou, 1961**	***Tapirus*** **Campbell, 1936**	***Tapirus*** **Murie, 1871**	***Tapirus*** **Windle & Parsons, 1901**
PANNICULUS CARNOSUS	**? coraco-brachialis** I: GT, SS, LD, pectorals		**cutaneus trunci** O: sides I: LT w/ PP, LD		**peaucier du tronc**	**panniculus carnosus** O: sides I: fascia over triceps	**panniculus carnosus** O: sides, ribs I: w/ LD + PS, deltoid fascia	
STERNO-FACIALIS								
STERNOMASTOIDEUS			**sterno-cephalicus** O: angle mandible I: sternum		**sterno-céphalique**	**sternomandibularis** O: angle mandible I: manubrium	**cephalo-humeral = sterno-mastoid: first portion** O: angle of mandible I: manubrium	O: angle of mandible
CLEIDOMASTOIDEUS			**brachiocephalicus** O: mastoid process, occipital crest I: clavicular intersection		**brachio-cephalique, partie dorsal**	**sternocephalicus** O: paramastoid I: manubrium	**cephalo-humeral = sternomastoid: second distinct belly** O: paramastoid w/ CT I: manubrium	
CLAVOTRAPEZIUS		**cephalo-humeralis**	**brachiocephalicus** O: mastoid process, occipital crest I: clavicular intersection		**brachio-cephalique, partie ventral**	**cephalohumeralis sive brachiocephalicus** O: mastoid region I: w/ PS; clavicular intersection	**cephalo-humeral = sterno-mastoid: third separate belly** O: paramastoid w/ CM I: clavicular intersection	**cephalo-humeralis** O: occipital crest
CEPHALOHUMERALIS			**CT + CM + OT / CD**			**CT / CD**		
ACROMIOTRAPEZIUS			**trapezius cervicalis** O: ligamentum nuchae - T3 I: spine scapula		**trapeze partie anterieure**	**trapezius** O: ligamentum nuchae, T1-13 I: tuberosity on spine scapula; fascia IN	**trapezius** O: occiput, C1-T1, ?slip to paramastoid	
DORSO-CUTANEUS								

	Rhinocerotidae		Equidae		Tapiridae			
	Dicerorhinus **Beddard & Treves, 1889**	***Rhinoceros*** **Windle & Parsons, 1901**	***Equus*** **Sisson, 1914**	***Equus*** **Windle & Parsons, 1901**	***Tapirus*** **Bressou, 1961**	***Tapirus*** **Campbell, 1936**	***Tapirus*** **Murie, 1871**	***Tapirus*** **Windle & Parsons, 1901**
SPINOTRAPEZIUS			**trapezius thoracalis** O: T3-10 I: tuber spinae	 O: T1-10 I: base spine scapula	**trapeze partie posterieur**			 O: T1-8
RHOMBOIDEUS CAPITIS				**r. capitis** absent				**r. capitis** absent
RHOMBOIDEUS CERVICIS	**rhomboideus** I: vertebral border scapula	**r. colli et thoracis** I: deep surface cartilaginous portion scapula	**r. cervicalis** O: ligamentum nuchae - T2 I: deep surface cartilage scapula	**r. colli et thoracis** I: deep surface cartilaginous portion scapula		**rhomboideus, cervical part** O: ligamentum nuchae, T1-3 I: vertebral border scapula	**rhomboideus** O: ligamentum nuchae, mid-thoracic vertebrae I: vertebral border scapula	**r. colli et thoracis** I: deep surface cartilaginous portion scapula
RHOMBOIDEUS THORACIS			**r. thoracalis** O: T2-7 I: deep surface cartilage scapula			**rhomboideus, thoracic part** O: T1-6 I: vertebral border scapula		
OMOTRANSVERSARIUS "metacromion"	**supraspinatus** O: "neck" I: supraspinatus	**omo-trachelien** O: atlas I: clavicular intersection	**brachiocephalicus** O: C1-4 I: clavicular intersection	**omo-trachelien** O: C1-4 I: clavicular intersection		**transversohumeralis** ? I: fascia over TLA		**omo-trachelien** O: atlas I: fascia over scapula
OMOTRANSVERSARIUS								
OMOHYOIDEUS		**omo-hyoid**	**omo-hyoideus** O: hyoid I: subscapular fascia					**omo-hyoid** I: scapula
SERRATUS VENTRALIS CERVICIS	**levator anguli scapulae** "a separate one cannot be made out"	**levator anguli scapulae**	**serratus ventralis cervicis** O: C3-7 I: deep surface scapula	**levator anguli scapulae** O: C3-7		**serratus anterior** O: C1-7 I: deep surface vertebral border scapula	**levator anguli scapulae**	**levator anguli scapulae** O: C3-7

	Rhinocerotidae		Equidae		Tapiridae			
	Dicerorhinus **Beddard & Treves, 1889**	***Rhinoceros*** **Windle & Parsons, 1901**	***Equus*** **Sisson, 1914**	***Equus*** **Windle & Parsons, 1901**	***Tapirus*** **Bressou, 1961**	***Tapirus*** **Campbell, 1936**	***Tapirus*** **Murie, 1871**	***Tapirus*** **Windle & Parsons, 1901**
SERRATUS VENTRALIS THORACIS	**serratus magnus** I: deep surface of scapula	**serratus magnus**	**serratus ventralis thoracis** O: ribs 1-9 I: deep surface scapula	**serratus magnus** O: ribs 1-9 I: deep surface scapula		**serratus anterior** O: ribs 1-9 I: deep surface vertebral border scapula	**serratus magnus** O: C3-7 I: scapula	**serratus magnus** O: ribs 1-7 I: deep surface scapula
CLAVODELTOIDEUS		**cephalo-humeralis** O: clavicular intersection	**brachiocephalicus** O: clavicular intersection I: to distal H	**cephalo-humeralis** O: clavicular intersection I: distal H		**cephalohumeralis sive brachiocephalicus** O: clavicular intersection I: cranial H from deltoid crest to medial epicondyle	**cephalo-humeral = sterno-mastoid: third separate belly** O: clavicular intersection I: H	**cephalo-humeralis** O: clavicular intersection I: distal H
ACROMIODELTOIDEUS		**deltoid, acromial part**	**deltoideus** O: caudal border scapula I: w/ SD on deltoid tuberosity	**deltoid, acromial part**		**acromiodeltoid** O: OT I: fascia TLA	**deltoid** O: fascia scapula	**deltoid, acromial part** "feebly developed"
SPINODELTOIDEUS		**deltoid, spinous portion** O: spine scapula + fascia IN	**deltoideus** O: spine scapula I: w/ AD on deltoid tuberosity	**deltoid, spinous portion** O: spine scapula + fascia IN		**deltoideus, scapular division** O: fascia IN + caudal border scapula I: deltoid tuberosity	**deltoid** O: fascia over IN	**deltoid, spinous portion** O: spine scapula + fascia IN
TERES MINOR		**teres minor** O: caudal border I: GT	**teres minor** O: caudal border I: proximal to deltoid tuberosity	**teres minor** O: caudal border I: GT		**teres minor** O: caudal border I: lateral GT	**teres minor** O: pit below glenoid I: tuberosity above deltoid	**teres minor** O: caudal border I: GT
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT		**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT
TERES MAJOR	**teres major** O: SS + caudal border scapula I: cranial H w/ TMA		**teres major** O: caudal border scapula I: teres tubercle w/ LD	**teres major**		**teres major** O: caudal angle I: w/ LD medial H		**teres major**

	Rhinocerotidae		Equidae		Tapiridae			
	Dicerorhinus **Beddard & Treves, 1889**	***Rhinoceros*** **Windle & Parsons, 1901**	***Equus*** **Sisson, 1914**	***Equus*** **Windle & Parsons, 1901**	***Tapirus*** **Bressou, 1961**	***Tapirus*** **Campbell, 1936**	***Tapirus*** **Murie, 1871**	***Tapirus*** **Windle & Parsons, 1901**
LATISSIMUS DORSI "superficial" "deep"	**latissimus dorsi** I: cranial H w/ TMA		**latissimus dorsi** O: lumbo-dorsal fascia I: teres tubercle w/ TMA	**latissimus dorsi** O: T vertebrae, ribs		**latissimus dorsi** O: thoracolumbar fascia, T6-L, ribs 9-11 I: medial H w/ TMA	**latissimus dorsi** O: T1-9 I: LT or bicipital ridge w/ TMI	**latissimus dorsi** O: ?, ribs
DORSO-EPITROCHLEARIS	**latissimus dorsi** O: LD I: aponeurosis of triceps + fascia forearm		**tensor fascia antibrachii** O: LD + caudal border scapula I: olecranon + forearm fascia	**dorso-epitrochlearis** O: caudal border scapula		**dorso-epitrochlearis** O: caudal border scapula, TLO, LD I: w/ TLO, forearm fascia	**dorsi epitrochlear** O: LD I: medial olecranon + medial epicondyle	**dorso-epitrochlearis** O: LD
PECTORALIS SUPERFICIALIS "clavicular"								
PECTORALIS SUPERFICIALIS "superficial"		**pectoralis, superficial** O: manubrium + sternum I: pectoral ridge + H	**pectoralis superficialis pars descendens** O: manubrium I: cranial H	**pectoralis, superficial** O: manubrium + sternum I: pectoral ridge + H		**pectoralis superficialis** O: manubrium + sternum I: cranial H, fascia forearm	**pectoralis major** O: manubrium + sternum	**pectoralis, superficial** O: manubrium + sternum I: pectoral ridge + H
PECTORALIS SUPERFICIALIS "deep"		**pectoralis, superficial** O: sternum I: fascia of forearm near elbow	**pectoralis superficialis pars transversa** O: sternum + midline raphe I: H w/ PSs	**pectoralis, superficial** O: sternum I: fascia of forearm near elbow				**pectoralis, superficial** O: sternum I: fascia of forearm near elbow
PECTORALIS PROFUNDUS		**pectoralis minor** O: sternum I: GHj capsule w/ PA		**pectoralis minor** O: sternum I: GHj capsule w/ PA		**pectoralis profundus** O: manubrium, sternum, abdomen I: deltoid process + GT		**pectoralis minor** O: sternum I: GHj capsule w/ PA
PECTORALIS ABDOMINALIS		**pectoralis quartus** O: sternum + linea alba I: GT + PC	**pectoralis profundus pars humeralis s. ascendens** O: abdomen + xiphoid + ribs 4-9 I: LT + GT	**pectoralis quartus** O: sternum + linea alba I: GT + PC				**pectoralis quartus** O: sternum + linea alba I: GT + PC

	Rhinocerotidae		Equidae		Tapiridae			
	***Dicerorhinus* Beddard & Treves, 1889**	***Rhinoceros* Windle & Parsons, 1901**	***Equus* Sisson, 1914**	***Equus* Windle & Parsons, 1901**	***Tapirus* Bressou, 1961**	***Tapirus* Campbell, 1936**	***Tapirus* Murie, 1871**	***Tapirus* Windle & Parsons, 1901**
SUBCLAVIUS								
STERNOSCAPULARIS			**pectoralis profundus pars scapularis** O: sternum + ribs 1-4 I: fascia of S	**subclavius + sterno-scapularis** O: manubrium + ribs 1-3 I: fascia over supraspinatus		**subclavius** O: manubrium + sternum I: fascia over S + vertebral border scapula	**sternoscapular** O: CT + PP, ribs 1-3 I: cranial angle scapula	**subclavius + sterno-scapularis** O: manubrium + ribs 1-3 I: fascia over supraspinatus
CORACOBRACHIALIS	**coraco-brachialis** O: coracoid process I: cranial H		**coraco-brachialis brevis** O: coracoid process I: teres tubercle		**coraco-brachial** O: acromion I: medial H, poorly divided into 2	**coracobrachialis medius** O: coracoid process I: cranio-medial H	**coraco-brachialis** O: coracoid process I: cranial H	**coraco-brachialis medius** I: middle H
CORACOBRACHIALIS			**coraco-brachialis brevis** O: coracoid process I: middle of cranial H					**coraco-brachialis longus** I: distal H
BICEPS BRACHII, short head	**biceps** O: coracoid process I: R neck	**biceps flexor longus cubiti** O: coracoid I: R		**biceps flexor longus cubiti** O: coracoid I: R	**biceps brachial** O: coracoid I: R + U	**biceps brachii** O: lateral coracoid I: R + U	**biceps** O: coracoid process I: medial R	**biceps flexor longus cubiti** O: coracoid I: R
BICEPS BRACHII, long head			**biceps brachii** O: tuber scapulae I: R					
BRACHIALIS		**brachialis anticus** O: caudal neck H	**brachialis** O: proximal caudal H I: medial R	**brachialis anticus** O: caudal neck H	**brachial** O: lateral H I: R + U	**brachialis** O: caudo-medial and lateral H I: medial R + U	**brachialis anticus** O: caudal H I: R	**brachialis anticus** O: caudal neck H
CUBITALIS								
SUPRASPINATUS	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT + LT	**supraspinatus** O: supraspinaous fossa I: GT + LT	**supraspinatus** O: supraspinous fossa I: GT + LT		**supraspinatus** O: supraspinous fossa I: GT + LT	**supraspinatus** O: supraspinous fossa	**supraspinatus** O: supraspinous fossa I: GT + LT
INFRASPINATUS	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT		**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus**	**infraspinatus** O: infraspinous fossa I: GT

	Rhinocerotidae		Equidae		Tapiridae			
	Dicerorhinus **Beddard & Treves, 1889**	***Rhinoceros*** **Windle & Parsons, 1901**	***Equus*** **Sisson, 1914**	***Equus*** **Windle & Parsons, 1901**	***Tapirus*** **Bressou, 1961**	***Tapirus*** **Campbell, 1936**	***Tapirus*** **Murie, 1871**	***Tapirus*** **Windle & Parsons, 1901**
TRICEPS BRACHII CAPUT LATERALE				**triceps brachii, lateral head** O: deltoid tuberosity I: lateral olecranon + TLO		**triceps brachii caput laterale** O: lateral H I: lateral olecranon	**triceps**	
TRICEPS BRACHII CAPUT MEDIALE				**triceps brachii, medial head** O: middle medial H I: medial olecranon		**triceps brachii caput mediale** O: medial H I: proximal olecranon	**triceps**	
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)						**triceps brachii caput longum, medial division** O: near glenoid on caudal border scapula	**triceps**	
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)				**triceps brachii, long head** O: caudal border scapula I: caudo-lateral olecranon		**triceps brachii caput longum, lateral division** O: caudal border scapula		
TRICEPS BRACHII ACCESSORY						**triceps brachii caput longum, third division** O: near glenoid on caudal border scapula I: w/ TLO distal olecranon		
ANCONEUS			**anconeus** O: distal caudal H I: lateral olecranon		**petit ancone** O: olecranon fossa H I: olecranon	**triceps anconeus** O: TME I: medial olecranon	**triceps, fourth part** I: caudal H	
BRACHIORADIALIS	**supinator longus** O: lateral epicondyle I: distal R	**supinator longus** present		**supinator longus** absent	**long supinateur** O: w/ ECR I: distal R	**brachioradialis** O: lateral supracondylar ridge I: distal R	**supinator longus** O: lateral supracondylar ridge I: medial R	**supinator longus** present

	Rhinocerotidae		Equidae		Tapiridae			
	Dicerorhinus **Beddard & Treves, 1889**	***Rhinoceros*** **Windle & Parsons, 1901**	***Equus*** **Sisson, 1914**	***Equus*** **Windle & Parsons, 1901**	***Tapirus*** **Bressou, 1961**	***Tapirus*** **Campbell, 1936**	***Tapirus*** **Murie, 1871**	***Tapirus*** **Windle & Parsons, 1901**
EXT CARPI RADIALIS, longus (MC2)								
EXT CARPI RADIALIS, brevis (MC3)	**ext metacarpi** O: lateral epicondyle + R I: base MC3	**ext carpi radiales longior & brevior** I: base cannon bone	**ext carpi radialis** O: lateral epicondyle I: base MC3	**ext carpi radiales longior & brevior** I: base cannon bone		**ext carpi radialis** O: lateral epicondyle I: base MC3	**ext carpi radialis longior and brevior** O: lateral supracondylar ridge I: MC3	**ext carpi radiales longior & brevior** I: MC3
EXT DIGITORUM COMMUNIS	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4	**common digitial extensor / ext. digitialis communis** O: lateral epicondyle + R + U I: digit 3	**ext communis digitorum** O: lateral epicondyle + R I: digit 3 + EDL		**ext digitorum communis** O: lateral epicondyle I: MC2, digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle + R I: digits 2, 3, 4	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5
EXT DIGITORUM LATERALIS	**ext lateralis digitorum** O: lateral epicondyle I: digits 3, 4	**ext minimi digiti** O: lateral epicondyle I: digits 4+5	**lateral digitial extensor / ext digitalis lateralis** O: lateral R + U I: digit 3	**ext minimi digiti** O: proximal R + U I: digit 3	**ext cubital des phalanges** O: U I: digits 4+5	**ext digitorum lateralis** O: lateral epicondyle + U I: digits 4+5	**ext medii digiti + ext minimi digiti** O: lateral epicondyle + U I: digits 3, 4	**ext minimi digiti** O: lateral epicondyle I: digits 4+5
EXT CARPI ULNARIS		**ext carpi ulnaris** O: lateral epicondyle I: MC4	**ulnaris lateralis** O: lateral epicondyle I: pisiform + MC4	**ext carpi ulnaris** O: lateral epicondyle I: pisiform w/ FCU, slip to MC4	**cubital externe** O: lateral epicondyle I: MC5	**ext carpi ulnaris** O: distal lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: MC5
SUPINATOR		**supinator brevis** absent		**supinator brevis** absent			**supinator brevis** absent	**supinator brevis** absent
ABD POLLICIS LONGUS	**ext onliquus metacarpi** O: lateral epicondyle + R I: MC2	**ext ossis metacarpi pollicis** O: R + U, lateral epicondyle I: MC2	**ext carpi obliquus** O: lateral R I: MC2	**ext ossis metacarpi pollicis** I: MC2		**abd pollicis longus** O: U + R I: base MC2	**ext ossis metacarpi pollicis** O: U + R I: MC2	**ext ossis metacarpi pollicis** O: R + U I: MC2
EXT DIGITORUM PROFUNDUS					**ext pollicis longus** O: U I: digit 1		**ext primi / ext secundi internodii / ext indicis** absent	
EXT BREVIS DIGITORUM								

	Rhinocerotidae		Equidae		Tapiridae			
	Dicerorhinus **Beddard & Treves, 1889**	***Rhinoceros*** **Windle & Parsons, 1901**	***Equus*** **Sisson, 1914**	***Equus*** **Windle & Parsons, 1901**	***Tapirus*** **Bressou, 1961**	***Tapirus*** **Campbell, 1936**	***Tapirus*** **Murie, 1871**	***Tapirus*** **Windle & Parsons, 1901**
PRONATOR TERES		**pronator teres** absent	**pronator teres** O: medial epicondyle I: medial collateral ligament elbow		**rond pronateur** "bien développé"	**pronator teres** O: medial epicondyle I: distal R	**pronator radii teres** "scant"	**pronator teres** feeble
FLX CARPI RADIALIS	**flx internus metacarpi** O: medial epicondyle I: MC2	**flx carpi radialis** O: medial epicondyle	**flx carpi radialis** O: medial epicondyle I: MC2	**flx carpi radialis** O: medial epicondyle	**grand palmaire** O: medial epicondyle I: base MC3	**flx carpi radialis** O: medial epicondyle I: base MC2+3	**flx carpi radialis** O: medial epicondyle	**flx carpi radialis** O: medial epicondyle
PALMARIS LONGUS	**flx obliquus metacarpi** O: medial epicondyle, olecranon I: ulnar sesamoid + pisiform	**palmaris longus** absent		**palmaris longus** absent				**palmaris longus** absent
FLX DIGITORUM SUPERFICIALIS	**flx sublimis (perforatus)** O: medial epicondyle I: digits 2, 3, 4	**flx sublimis digitorum** I: digits 2, 3, 4	**superficial digitial flexor / flx digitalis superficialis (u+m)** O: medial epicondyle + R I: digit 3	**flx sublimis digitorum** I: digit 3	**flx superficiel des phalanges** O: FDPe I: digits 2f, 3f, 4f	**flx digitorum sublimis (m+u)** O: FDPe I: digits 2f, 3f, 4f	**palmaris longus** O: medial olecranon I: FDP/FDS, palmar fascia	**flx sublimis digitorum** I: digits 2, 3, 4
INTERFLEXORII								
FLX DIGITORUM PROFUNDUS,	**flx profundus (perforans) + palmaris longus**	**flx profundus digitorum**	**deep digitial flexor / flx digitalis profundus**	**flx profundus digitorum**	**flx profund des phalanges**	**flx digitorum profundus**		**flx profundus digitorum**
epicondylar			(m+u)					
epicondylar (FDPe)	O: medial epicondyle		O: medial epicondyle (3 heads)	O: medial epicondyle	O: medial epicondyle	O: distal medial epicondyle (m+u)		O: medial epicondyle
epicondylar (FDPd)					O: H	O: distal medial epicondyle (m+u)		O: medial epicondyle
ulnar	O: olecranon		O: medial olecranon	O: medial olecranon	O: U	O: medial olecranon (u)		O: medial olecranon
radial	*I: digits 2, 3, 4	*I: digits 2, 3, 4	O: R *I: digit 3	O: R *I: digit 3	*I: dig 2, 3, 4, 5	O: medial R (m) *I: dig 2, 3, 4, 5		O: R *I: digits 2, 3, 4, 5
LUMBRICALES		**lumbricales** absent	**lumbricales (m+u)** O: FDP tendon I: 2 for digit 3	**lumbricales** I: 2 for digit 3	**lombricaux** O: FDS I: digits 2, 4	**lumbricales manus** O: FDP tendon I: medial digits 2, 3, 4	**lumbricales** O: FDP/FDS I: medial digits 2, 3, 4	**lumbricales** I: digits 2, 3, 4

	Rhinocerotidae		Equidae		Tapiridae			
	Dicerorhinus **Beddard & Treves, 1889**	***Rhinoceros*** **Windle & Parsons, 1901**	***Equus*** **Sisson, 1914**	***Equus*** **Windle & Parsons, 1901**	***Tapirus*** **Bressou, 1961**	***Tapirus*** **Campbell, 1936**	***Tapirus*** **Murie, 1871**	***Tapirus*** **Windle & Parsons, 1901**
FLX CARPI ULNARIS, **epitrochlear belly** **ulnar belly**	**flx externis metacarpi** O: medial epicondyle O: medial olecranon I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: medial olecranon	**flx carpi ulnaris** O: medial epicondyle O: medial olecranon I: pisiform	**flx carpi ulnaris** O: medial epicondyle	**cubital interne** O: medial epicondyle - I: pisiform	**flx carpi ulnaris** O: medial epicondyle - I: pisiform	**flx carpi ulnaris** "no peculiarity"	**flx carpi ulnaris** O: medial epicondyle
EPITROCHLEO-ANCONEUS						**flx carpi ulnaris, strong fascial band** O: medial epicondyle I: olecranon		
PRONATOR QUADRATUS		**pronator quadratus** absent		**pronator quadratus** absent			**pronator quadratus** O: U + R	**pronator quadratus** absent
PALMARIS BREVIS								
FLX DIGITORUM BREVIS MANUS					**palmaire cutane** I: digit 5	**flx brevis manus** O: fascia near MC5 I: 5f	**flx brevis manus** O: palmar fascia I: digits 2, 3, 4, 5	**flx brevis digitorum manus** absent
ABD DIGITI MINIMI		**abd minimi digiti** O: pisiform			**abd du doigt V** O: pisiform I: MC5	**abd digiti quinti manus** O: pisiform I: lateral digit 5	**abd minimi digiti** O: pisiform I: sesamoid digit 5	**abd minimi digiti** O: pisiform
ABD POLLICIS BREVIS								
CONTRAHENTES					**add du doigt V** I: digit 5	**contrahentes digitorum manus** O: capitate + I I: digits 2, 4, 5	**interossei** O: deep palmar fascia I: digits 1, 5, 5	
FLEXOR BREVES PROFUNDUS	**interossei** 4	**interossei or flexores breves** 3	**interossei** 3	**interossei or flexores breves** 3	**interosseux metacarpiens + court flechisseur du doigt V** 8	**flx breves profundi manus** 8	**interossei** 8	**interossei or flexores breves** 8
INTERMETACARPALES								
? Unknown homology			**capsularis** O: near glenoid I: caudal H behind head	**subscapularis accessorius** O: caudal border scapula I: near GHj capsule			**? separate small bundle of infraspinatus** O: caudal border scapula	
RADIAL SESAMOID "PRE-POLLUX"								
ULNAR SESAMOID	present							
CARPAL VIBRISSAE								

	PHOLIDOTA	CARNIVORA						
		Feliforms						
	Manidae	**Felidae**					**Viverridae**	
	Manis **Humphry, 1869b**	***Leopardus*** **Julik et al., 2012**	***Leptailurus*** **Diogo et al., 2012a**	***Felis*** **Getty, 1975**	***Felis*** **Reighard & Jennings, 1901**	***Panthera*** **Diogo et al., 2012a**	***Civettictis*** **Devis, 1868**	***Genetta*** **Mivart, 1882**
PANNICULUS CARNOSUS					**cutaneus maximus** O: lateral + ventral sides I: bicipital arch in axilla		**panniculus carnosus** I: w/ LD, medial forearm	
STERNO-FACIALIS								
STERNOMASTOIDEUS	**sterno-mastoid** ?	**sternocephalicus pars occipitalis et pars mastoidea** O: occiput + mastoid process I: manubrium	**sternocephalicus pars occipitalis et pars mastoidea** O: nuchal crest + mastoid process I: manubrium	**sternocephalicus - sterno-occipitalis + sternomastoideus** O: occiput + mastoid process I: manubrium	**sternomastoideus** O: lambdoidal ridge I: manubrium	**sternocephalicus pars occipitalis et pars mastoidea** O: nuchal crest + mastoid process I: manubrium	**sternocleido-mastoideus** I: sternum	
CLEIDOMASTOIDEUS		**brachiocephalicus - cleidomastoideus** O: mastoid process I: clavicle + clavicular intersection	**cleidomastoideus** O: nuchal crest, mastoid process I: clavicle + clavicular intersection	**brachiocephalicus - cleidocephalicus - cleidomastoideus** O: mastoid process I: clavicular intersection	**cleidomastoideus** O: mastoid process I: clavicle	**cleidomastoideus** O: mastoid process I: clavicle + clavicular intersection	**sternocleido-mastoideus** I: rudimentary clavicle	
CLAVOTRAPEZIUS	**cleido-occipital** ?	**brachiocephalicus - cleidocephalicus** O: nuchal crest, ligamentum nuchae I: clavicle + clavicular intersection	**cleido-occipitalis** O: nuchal crest, C1-3 I: clavicle + clavicular intersection	**brachiocephalicus - cleidocephalicus - cleidocervicalis** O: proximal ligamentum nuchae I: clavicular intersection	**clavotrapezius** O: lambdoidal crest I: clavicle	**cleido-occipitalis**	**sternocleido-mastoideus** I: rudimentary clavicle	**cephalo-humeral** "as in cat"

	PHOLIDOTA	CARNIVORA						
		Feliforms						
	Manidae	Felidae					Viverridae	
	Manis **Humphry, 1869b**	***Leopardus*** **Julik et al., 2012**	***Leptailurus*** **Diogo et al., 2012a**	***Felis*** **Getty, 1975**	***Felis*** **Reighard & Jennings, 1901**	***Panthera*** **Diogo et al., 2012a**	***Civettictis*** **Devis, 1868**	***Genetta*** **Mivart, 1882**
CEPHALOHUMERALIS								
ACROMIOTRAPEZIUS	**trapezius** O: occipito-mastoid, T spines I: spine scapula + CD	**trapezius pars cervicalis** ? I: spine scapula	**acromiotrapezius** O: C3-T4 I: spine scapula w/ OT	**trapezius** O: C3-T9 I: spine scapula	**acromiotrapezius** O: C1-T4 I: metacromion + spine scapula	**acromiotrapezius** O: C3-T3 I: spine scapula + fascia S + IN w/ OT	**trapezius** O: ligamentum nuchae I: spine scapula	**trapezius** "as in cat"
DORSO-CUTANEUS					-			
SPINOTRAPEZIUS		**trapezius pars thoracica** ? I: spine scapula	**spinotrapezius** O: T3-10 I: spine scapula		**spinotrapezius** O: T4-13 I: tuberosity spine scapula	**spinotrapezius** O: T3-10 I: spine scapula	**trapezius**	
RHOMBOIDEUS CAPITIS	**occipito-scapular** O: occiput, ligamentum nuchae I: spine scapula	**r. capitis** O: occiput, C1 I: vertebral border scapula		**r. capitis** O: occiput I: vertebral border scapula	**occipitoscapularis** O: lambdoidal ridge I: cranial angle scapula		**occipito-scapularis** absent	**r. capitis** absent
RHOMBOIDEUS CERVICIS	**rhomboideus** O: T3-4 I: vertebral border scapula	**r. cervicis** O: C2-T1 I: vertebral border scapula		**r. cervicis** O: C2-T3 I: vertebral border scapula	**rhomboideus** O: C ?-T4 I: vertebral border scapula		**rhomboideus** O: C-T2 I: vertebral border scapula	**rhomboideus** O: C3-T4
RHOMBOIDEUS THORACIS	**rhomboideus, superficial stratum** O: 3T I: caudal angle scapula	**r. thoracis** O: T2-3 I: vertebral border scapula		**r. thoracis** O: T3-? I: vertebral border scapula				

	PHOLIDOTA	CARNIVORA						
		Feliforms						
	Manidae	Felidae					Viverridae	
	Manis Humphry, 1869b	*Leopardus* Julik et al., 2012	*Leptailurus* Diogo et al., 2012a	*Felis* Getty, 1975	*Felis* Reighard & Jennings, 1901	*Panthera* Diogo et al., 2012a	*Civettictis* Devis, 1868	*Genetta* Mivart, 1882
OMOTRANSVERSARIUS "metacromion"	**masto-scapular** O: mastoid I: spine scapula	**omotransversarius** O: atlas I: acromion		**omotransversarius** O: atlas + basilar occiput I: acromion	**levator scapulae ventralis** O: atlas + basioccipital I: metacromion		**acromio-trachelien** O: atlas I: acromion	**levator claviculae** "as in cat"
OMOTRANSVERSARIUS								
OMOHYOIDEUS	**omohyoid** absent		**omohyoideus** absent			**omohyoideus** absent		
SERRATUS VENTRALIS CERVICIS	**levator scapulae** C3-7 I: cranial border	w/ SVT		**serratus ventralis cervicis** O: C2-7 I: deep surface	**levator scapulae** w/ SVT		**levator scapulae** w/ SVT	**levator anguli scapulae** O: C4-7
SERRATUS VENTRALIS THORACIS	**serratus magnus** ?	**serratus ventralis** O: C3-T1, ribs 1-8 I: deep surface vertebral border scapula		**serratus ventralis thoracis** O: ribs 1-8 I: deep surface scapula	**serratus anterior** O: C3-7, ribs 1-10 I: deep surface vertebral border scapula		**serratus magnus** O: C3-?, ribs 1-8	**serratus magnus** O: ribs 1-9
CLAVODELTOIDEUS	**trapezius** O: AT I: pectoral crest H	**brachiocephalicus - cleidobrachialis** O: clavicular intersection I: w/ PS + w/ B proximal U		**brachiocephalicus - cleidobrachialis** O: clavicular intersection I: w/ PS deltoid tuberosity	**clavobrachialis** O: clavicle I: medial U w/ B			

	PHOLIDOTA	CARNIVORA						
		Feliforms						
	Manidae	**Felidae**					**Viverridae**	
	Manis **Humphry, 1869b**	***Leopardus*** **Julik et al., 2012**	***Leptailurus*** **Diogo et al., 2012a**	***Felis*** **Getty, 1975**	***Felis*** **Reighard & Jennings, 1901**	***Panthera*** **Diogo et al., 2012a**	***Civettictis*** **Devis, 1868**	***Genetta*** **Mivart, 1882**
ACROMIODELTOIDEUS	**deltoid** "not… a distinct muscle"	**deltoideus pars acromialis** O: acromion I: H		**deltoideus pars acromialis** O: acromion I: w/ SD deltoid tuberosity	**acromiodeltoideus** O: acromion I: w/ SD + H		**deltoideus** O: acromion I: deltoid ridge H	**deltoid** "as in cat"
SPINODELTOIDEUS	**supinator longus** O: spine scapula I: BR	**deltoideus pars scapularis** O: surface IN + acromion I: deltoid ridge H		**deltoideus pars scapularis** O: spine scapula I: w/ AD deltoid tuberosity	**spinodeltoideus** O: spine scapula I: deltoid ridge H		**deltoideus** O: fascia IN I: w/ AD	
TERES MINOR	**teres minor** O: spine scapula I: ridge distal to GT	**teres minor** O: caudal border scapula + TLO I: ridge on GT		**teres minor** O: caudal border scapula I: distal to GT	**teres minor** O: caudal border scapula I: distal to GT			**teres minor** "as in cat"
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT		**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT		**subscapularis** I: "as usual"	**subscapularis** "as in cat"
TERES MAJOR	**teres major** O: caudal border scapula I: medial H w/ LD	**teres major** O: caudal angle + border scapula I: w/ LD teres tuberosity		**teres major** O: caudal angle scapula I: w/ LD teres tuberosity	**teres major** O: caudal border scapula I: medial H w/ LD			**teres major** I: tendon of LD
LATISSIMUS DORSI	**latissimus dorsi** O: T-L vertebrae, ribs 5-?	**latissimus dorsi** O: thoracolumbar fascia to rib 13, T7-9		**latissimus dorsi** O: thoracolumbar fascia, 3 ribs	**latissimus dorsi** O: T5-L6		**latissimus dorsi** O: "as usual"	**latissimus dorsi** "as in cat"
"superficial"	I: medial bicipital ridge	I: w/ PP		I: w/ TMA teres tuberosity, slip to PS	I: medial H w/ TMA		I: ridge medial H w/ TMA	
"deep"		I: teres major tuberosity H w/ TMA						

	PHOLIDOTA	CARNIVORA						
		Feliforms						
	Manidae	Felidae					Viverridae	
	Manis **Humphry, 1869b**	***Leopardus*** **Julik et al., 2012**	***Leptailurus*** **Diogo et al., 2012a**	***Felis*** **Getty, 1975**	***Felis*** **Reighard & Jennings, 1901**	***Panthera*** **Diogo et al., 2012a**	***Civettictis*** **Devis, 1868**	***Genetta*** **Mivart, 1882**
DORSO-EPITROCHLEARIS	**latissimus dorsi** O: LD I: FDS	**tensor fasciae antebrachii** O: LD I: TME + medial forearm fascia		**tensor fasciae antebrachii** O: TLO I: olecranon + forearm fascia	**epitrochlearis** O: LD I: olecranon		**omoanconeus** O: LD I: fascia medial forearm	**dorso-epitrochlear** present
PECTORALIS SUPERFICIALIS "clavicular"					**pectoantibrachialis** O: manubrium I: fascia forearm w/ CD			
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis major** O: sternum + linea alba I: pectoral crest H	**pectoralis superficialis, superficial layer** O: sternum I: w/ CD, GT + cranial H		**pectorales superficiales** O: sternum I: crest H, clavicle, U	**pectoralis major (ectopectoralis), superficial** O: manubrium I: middle pectoral ridge H		**pectoralis major** O: manubrium + sternum I: proximal cranial H	**pectoralis** "as in cat"
PECTORALIS SUPERFICIALIS "deep"		**pectoralis superficialis, deep layer** O: sternum I: GT + cranial H			**pectoralis major (ectopectoralis), deep** O: manubrium I: distal pectoral ridge H		**pectoralis minor, first** O: sternum I: fossa medial head H	
PECTORALIS PROFUNDUS	**pectoralis minor** absent?	**pectoralis profundus (2 bellies)** O: sternum I: GT + cranio-medial H		**pectoralis profundus** O: sternum I: LT + GT	**pectoralis minor (entopectoralis)** O: sternum I: proximal pectoral ridge H		**pectoralis minor, second** O: xiphisternum I: distal head H	

	PHOLIDOTA	CARNIVORA						
		Feliforms						
	Manidae	Felidae					Viverridae	
	Manis **Humphry, 1869b**	***Leopardus*** **Julik et al., 2012**	***Leptailurus*** **Diogo et al., 2012a**	***Felis*** **Getty, 1975**	***Felis*** **Reighard & Jennings, 1901**	***Panthera*** **Diogo et al., 2012a**	***Civettictis*** **Devis, 1868**	***Genetta*** **Mivart, 1882**
PECTORALIS ABDOMINALIS	**brachialis lateralis** O: external oblique + PC I: medial bicipital ridge, LT	**pectoralis profundus, abdominal belly** I: w/ PP			**xiphihumeralis** O: xiphoid process + rectus abdominis I: w/ LD + PP		**pectoralis minor, third** O: abdominal aponeurosis I: w/ PP	
SUBCLAVIUS				**subclavius** absent				**subclavius** O: rib 1 I: rudimentary clavicle
STERNOSCAPULARIS				?PP "a small portion separated from the rest of the muscle along its caudal edge)				
CORACOBRACHIALIS	**coraco-brachialis** absent	**articularis humeri** O: coracoid process I: proximal medial H		**coracobrachialis** O: coracoid process I: teres tubercle	**coracobrachialis** O: coracoid process I: medial proximal H		**coracobrachialis** O: neck of scapula I: neck of H	
CORACOBRACHIALIS								
BICEPS BRACHII, short head								
BICEPS BRACHII, long head	**biceps** O: glenoid I: U	**biceps brachii** O: supraglenoid tubercle I: R tuberosity		**biceps brachii** O: supraglenoid tubercle I: R + U	**biceps brachii** O: supraglenoid tubercle I: R tuberosity			**biceps** O: glenoid I: R tubercle

	PHOLIDOTA	CARNIVORA						
		Feliforms						
	Manidae	Felidae					Viverridae	
	Manis **Humphry, 1869b**	***Leopardus*** **Julik et al., 2012**	***Leptailurus*** **Diogo et al., 2012a**	***Felis*** **Getty, 1975**	***Felis*** **Reighard & Jennings, 1901**	***Panthera*** **Diogo et al., 2012a**	***Civettictis*** **Devis, 1868**	***Genetta*** **Mivart, 1882**
BRACHIALIS	**brachialis anticus** O: cranio-lateral H I: U	**brachialis** O: proximal caudo-lateral H I: w/ CD medial U		**brachialis** O: sulcus brachialis I: w/ BB R	**brachialis** O: lateral H I: U w/ CD		**brachialis anticus** O: caudo-lateral H I: U	**brachialis anticus** "as in cat"
CUBITALIS				**articularis humeri**			**?** O: AT I: w/ B	
SUPRASPINATUS	**supra-spinatus** "nothing peculiar"	**supraspinatus** O: supraspinous fossa I: GT + ins PP		**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT		**supra-spinatus** "remarkable for strength"	**supraspinatus (divided)**
INFRASPINATUS	**infra-spinatus** "nothing peculiar"	**infraspinatus** O: infraspinous fossa I: near GT		**infraspinatus** O: infraspinous fossa I: near GT	**infraspinatus** O: infraspinous fossa I: distal GT		**infra-spinatus** "remarkable for strength"	**infraspinatus** "as in cat"
TRICEPS BRACHII CAPUT LATERALE	**triceps** O: GT + caudal H	**triceps brachii caput laterale** O: neck + proximal lateral H I: lateral olecranon + TLO		**triceps brachii, lateral head (3 portions)** O: lateral H I: w/ TLO	**triceps brachii caput laterale** O: lateral H I: lateral olecranon		**triceps, short head** O: lateral H	**triceps** "as in cat"

	PHOLIDOTA	CARNIVORA						
		Feliforms						
	Manidae	Felidae					Viverridae	
	Manis **Humphry, 1869b**	***Leopardus*** **Julik et al., 2012**	***Leptailurus*** **Diogo et al., 2012a**	***Felis*** **Getty, 1975**	***Felis*** **Reighard & Jennings, 1901**	***Panthera*** **Diogo et al., 2012a**	***Civettictis*** **Devis, 1868**	***Genetta*** **Mivart, 1882**
TRICEPS BRACHII CAPUT MEDIALE	**triceps, internal humeral** "small"	**triceps brachii caput mediale** O: proximal medial H I: medial olecranon		**triceps brachii, medial head** O: medial H I: medial olecranon	**triceps brachii capupt mediale long + intermediate + short portions** O: caudal H, caudal medial epicondyle I: medial olecranon		**triceps, third head** O: "as usual"	
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps, scapular portion** O: caudal border scapula I: cranial surface olecranon	**triceps brachii caput longum** O: caudal border scapula I: olecranon		**triceps brachii, long head** O: caudal border scapula I: caudal olecranon	**triceps brachii caput longum** O: caudal border scapula I: tip olecranon		**triceps, long head** O: caudal border scapula	
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)	**triceps, scapular portion** O: fascia over S + spine scapula I: lateral olecranon							
TRICEPS BRACHII ACCESSORY		**triceps brachii caput accessorium** O: proximal caudal H I: olecranon w/ TME		**triceps brachii, accessory head** O: caudal neck H I: olecranon				

	PHOLIDOTA	CARNIVORA						
		Feliforms						
	Manidae	Felidae					Viverridae	
	Manis **Humphry, 1869b**	***Leopardus*** **Julik et al., 2012**	***Leptailurus*** **Diogo et al., 2012a**	***Felis*** **Getty, 1975**	***Felis*** **Reighard & Jennings, 1901**	***Panthera*** **Diogo et al., 2012a**	***Civettictis*** **Devis, 1868**	***Genetta*** **Mivart, 1882**
ANCONEUS	**anconeus externus** O: caudal lateral epicondyle I: lateral olecranon	**anconeus** O: distal caudal H + lateral supracondylar crest (sesamoids) I: proximal lateral U		**anconeus** O: lateral epicondylar crest I: lateral U	**anconeus** O: distal caudal H I: lateral U			**anconeus** "as in cat"
BRACHIORADIALIS	**supinator longus** O: deltoid ???? I: distal lateral R	**brachioradialis** O: caudal H I: distal R		**brachioradialis** O: lateral epicondylar crest I: R	**brachioradialis** O: caudo-lateral H I: styloid process R		**supinator longus** "ordinary attachments" "thin & weak"	**supinator longus** O: distal H I: R
EXT CARPI RADIALIS, longus (MC2)		**ext carpi radialis longus** O: lateral epicondylar crest I: MC2		**ext carpi radialis longus** O: lateral epicondylar crest I: MC2	**ext carpi radialis longus** O: lateral supracondylar crest I: base MC2		**ext carp. rad. longus w/ brevis** O: lateral supracondylar ridge H I: MC2 + 3	**ext carpi radiales longior et brevior** "as in cat"
EXT CARPI RADIALIS, brevis (MC3)	**ext carpi radialis** O: lateral epicondyle I: MC3	**ext carpi radialis brevis** O: lateral epicondylar crest I: MC3		**ext carpi radialis brevis** O: lateral epicondylar crest I: MC3	**ext carpi radialis brevis** O: lateral supracondylar crest I: base MC3			
EXT DIGITORUM COMMUNIS	**ext digitorum** O: lateral epicondyle + U I: digits 3, 4, 5	**ext digitorum communis** O: lateral epicondylar crest I: digits 2, 3, 4, 5		**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral supracondylar crest I: digits 2, 3, 4, 5		**ext dig. communis** "as usual"	**ext communis digitorum** I: digits 2, 3, 4, 5

	PHOLIDOTA	CARNIVORA						
		Feliforms						
	Manidae	**Felidae**					**Viverridae**	
	Manis **Humphry, 1869b**	***Leopardus*** **Julik et al., 2012**	***Leptailurus*** **Diogo et al., 2012a**	***Felis*** **Getty, 1975**	***Felis*** **Reighard & Jennings, 1901**	***Panthera*** **Diogo et al., 2012a**	***Civettictis*** **Devis, 1868**	***Genetta*** **Mivart, 1882**
EXT DIGITORUM LATERALIS	**ext carpi ulnaris** O: lateral epicondyle I: digit 4, MC5	**ext digitorum lateralis** O: lateral epicondylar crest I: digits 2, 3, 4, 5 * 3 bellies		**ext digitorum lateralis** O: ulnar collateral ligament + R I: digits 2, 3, 4, 5 * 2 bellies	**ext digitorum lateralis** O: lateral supracondylar crest I: digits 3, 4, 5		**ext + single fleshy belly** I: digits 4, 5 * possibly double?	**ext minimi digiti** "as in cat"
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle + U I: MC5	**ext carpi ulnaris** O: lateral epicondyle I: MC5 + pisiform		**ext carpi ulnaris** O: lateral epicondyle I: MC5 + pisiform	**ext carpi ulnaris** O: lateral epicondyle I: base MC5		**ext carp. ulnaris** "as usual"	**ext longus ulnaris** "as in cat"
SUPINATOR	**supinator brevis** O: sesamoid that articulates w/ capitulum of R and lateral epicondyle I: cranial R	**supinator** O: lateral collateral ligament R I: proximal 2/3 R		**supinator** O: lateral collateral ligament R I: proximal R	**supinator** O: annular ligament R I: proximal R			**supinator brevis** "as in cat"
ABD POLLICIS LONGUS	**ext pollicis primus** O: U I: trapezium, digit 1	**abd digiti I longus** O: lateral U + R I: base MC1 + radial sesamoid		**abd digiti I (pollicis) longus** O: lateral R + U I: MC1 (sesamoid)	**ext brevis pollicis** O: lateral U + R I: base MC1 (radial sesamoid)			**ext ossis metacarpi pollicis** O: olecranon I: "as in cat"

	PHOLIDOTA	CARNIVORA						
		Feliforms						
	Manidae	**Felidae**					**Viverridae**	
	Manis **Humphry, 1869b**	***Leopardus*** **Julik et al., 2012**	***Leptailurus*** **Diogo et al., 2012a**	***Felis*** **Getty, 1975**	***Felis*** **Reighard & Jennings, 1901**	***Panthera*** **Diogo et al., 2012a**	***Civettictis*** **Devis, 1868**	***Genetta*** **Mivart, 1882**
EXT DIGITORUM PROFUNDUS	**ext indicis** O: distal U I: digits 1, 2, 3	**ext digiti I et II** O: proximal U I: digit 1, EDL2		**ext digiti I (pollicis) et II** O: middle U I: digits 1, 2, (3)	**ext indicis (proprius)** O: lateral U I: digits (1), 2, (3)			**ext indicis et secundii internodii pollicis** "as in cat"
EXT BREVIS DIGITORUM	**ext brevis digitorum** absent							
PRONATOR TERES	**pronator teres** O: medial epicondyle I: distal cranial R	**pronator teres** O: medial epicondyle I: distal 2/3 medial R		**pronator teres** O: medial epicondyle I: medial R	**pronator teres** O: medial epicondyle I: medial R			**pronator teres** "as in cat"
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: base MC1, 2, 3	**flx carpi radialis** O: medial epicondyle I: palmar base MC2 + 3		**flx carpi radialis** O: medial epicondyle I: palmar base MC2 + 3	**flx carpi radialis** O: medial epicondyle I: base MC2 + 3		**flx carpi radialis** O: not from U	**flx carpi radialis** "as in cat"
PALMARIS LONGUS	**flx digitorum sublimis** O: medial epicondyle + fascia forearm I: digit 1	**palmaris longus** O: medial epicondyle I: digits 2, 3, 4, 5		**palmaris longus** O: medial epicondyle I: digits 2, 3, 4, 5	**palmaris longus** O: medial epicondyle I: digits 2, 3, 4, 5		**palmaris longus** O: caudal medial epicondyle I: palm + digits	**palmaris longus** I: palmar fascia

	PHOLIDOTA	CARNIVORA						
		Feliforms						
	Manidae	Felidae					Viverridae	
	Manis **Humphry, 1869b**	*Leopardus* **Julik et al., 2012**	*Leptailurus* **Diogo et al., 2012a**	*Felis* **Getty, 1975**	*Felis* **Reighard & Jennings, 1901**	*Panthera* **Diogo et al., 2012a**	*Civettictis* **Devis, 1868**	*Genetta* **Mivart, 1882**
FLX DIGITORUM SUPERFICIALIS	**flx digitorum sublimis** O: medial epicondyle + FDP (3 parts) I: digits 1, 2, 3, 4	**flx digitorum superficialis** O: FDP I: digits 2, 3, 4		**flx digitorum superficialis (2 bellies)** O: PL + FDP I: digits 4, 5 / 2, 3	**flx sublimis digitorum** O: PL // FDP I: digits 4f, 5f // 2f, 3f, 4		**flx sublimis** O: FDP via 2 heads I: palmar cushions	**flx sublimis digitorum** O: FDP I: digits 2, 3, 4, 5
INTERFLEXORII				**interflexorii - 3**				
FLX DIGITORUM PROFUNDUS,	0	**flx digitorum profundus**		**flx digitorum profundus**	**flx profundus digitorum**		**flx dig. profundus**	**flx profundus digitorum**
epicondylar		0		0	O: medial epicondyle			O: medial epicondyle
epicondylar (FDPe)	O: medial epicondyle	O: caudal medial epicondyle		O: medial epicondyle (3 bellies)	O: medial epicondyle		O: medial epicondyle	O: medial epicondyle
epicondylar (FDPd)		O: medial epicondyle			O: distal medial epicondyle		O: medial epicondyle	O: medial epicondyle
ulnar	O: U	O: proximal 1/3 U		O: caudal U	O: medial U		O: U	O: U
radial	O: R	O: caudal U + R		O: caudomedial R	O: middle R		O: R	O: R
		*I: digits 1, 2, 3, 4, 5		*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5		*I: digits 1, 2, 3, 4, 5	
LUMBRICALES	**lumbricales** O: FDP sesamoid I: medial digits 2, 3, 4, 5	**lumbricales** O: FDP I: medial digits 2, 3, 4, 5		**lumbricales (u)** O: FDP I: medial digits 2, 3, 4, 5	**lumbricales** O: FDP I: medial digits 2, 3, 4, 5		**lumbricales** "distinct"	**lumbricales** "as in cat"

	PHOLIDOTA	CARNIVORA						
		Feliforms						
	Manidae	Felidae					Viverridae	
	Manis Humphry, 1869b	*Leopardus* Julik et al., 2012	*Leptailurus* Diogo et al., 2012a	*Felis* Getty, 1975	*Felis* Reighard & Jennings, 1901	*Panthera* Diogo et al., 2012a	*Civettictis* Devis, 1868	*Genetta* Mivart, 1882
FLX CARPI ULNARIS, **epitrochlear belly** **ulnar belly**	**flx carpi ulnaris** O: surface FDP O: medial olecranon I: MC4	**flx carpi ulnaris** O: medial epicondyle O: caudo-medial U I: pisiform		**flx carpi ulnaris** O: medial epicondyle O: U I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: U I: pisiform		**flx carpi ulnaris (2 bellies)** O: medial epicondyle w/ FDP? O: medial olecranon I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: medial olecranon I: pisiform
EPITROCHLEO-ANCONEUS	**anconeus internus** O: caudal medial epicondyle I: medial olecranon			**epitrochleo-anconeus** few fibers on medial elbow			**brachioeus posticus** O: medial H I: medial olecranon	
PRONATOR QUADRATUS	**pronator quadratus** absent	**pronator quadratus** O: distal U + R		**pronator quadratus** O: U + R	**pronator quadratus** O: distal 1/2 U + R		**pronator quadratus** "unusual strength"	**pronator quadratus** O: distal 1/3 R + U
PALMARIS BREVIS		**palmaris brevis** O: flx retinaculum I: metacarpal paw pad						
FLX DIGITORUM BREVIS MANUS	**flx digitorum sublimis** O: FDS I: lateral digit 5	**flx digitorum brevis manus** O: PL I: digits 4, 5		**flx digitorum brevis (u)** O: deep surface PL to digit 5 I: digit 5			**accessorius** O: flx retinaculum I: digit 5	
ABD DIGITI MINIMI		**abd digiti V** O: pisiform I: digit 5		**abd digiti V** O: pisiform I: digit 5 + sesamoid				

	PHOLIDOTA	CARNIVORA						
		Feliforms						
	Manidae	Felidae					Viverridae	
	Manis **Humphry, 1869b**	***Leopardus*** **Julik et al., 2012**	***Leptailurus*** **Diogo et al., 2012a**	***Felis*** **Getty, 1975**	***Felis*** **Reighard & Jennings, 1901**	***Panthera*** **Diogo et al., 2012a**	***Civettictis*** **Devis, 1868**	***Genetta*** **Mivart, 1882**
ABD POLLICIS BREVIS				**abd digiti I (pollicis) brevis** O: carpal ligament I: sesamoid or digit 1	**abd brevis pollicis** O: transverse ligament I: digit 1		**abd pollicis** "distinct"	
CONTRAHENTES	**interossei - adductors** O: scapho-lunar I: digits 1, 2, 4, 5	**add digitorum** O: carpal ligaments I: digits 1, 2, 5		**add digiti V, add digiti II, add digiti I** O: carpal ligament I: digits 1, 2, MC5	**add pollicis, add digiti secundi, opp digiti quinti** O: carpus I: 1L, 2L, 5M		**add pollicis**	
FLEXOR BREVES PROFUNDUS	**interossei - dorsal interossei, adb pollicis, flx brevis pollicis, abd + flx brevis minimi digiti** 9	**flx breves profundi** 9		**interossei + flx digiti I brevis + flx digiti V** 10	**flx brevis + interossei** 10			
INTERMETACARPALES								
? Unknown homology							**opp pollicis**	
? Unknown homology								
RADIAL SESAMOID "PRE-POLLUX"								
ULNAR SESAMOID								

	CARNIVORA							
	Feliforms continued			**Caniforms**				
	Hyaenidae			**Canidae**			**Ursidae**	
	Crocuta **Watson & Young, 1879**	***Hyaena*** **Spoor & Badoux, 1986a**	***Hyaena*** **Young & Robinson, 1889**	***Canis*** **Getty, 1975**	***Urocyon*** **Feeney, 1999**	***Vulpes*** **Feeney, 1999**	***Ailuropoda*** **Davis, 1964**	***Ursus*** **Kelley, 1888**
PANNICULUS CARNOSUS	**panniculus carnosus** O: dorsal + lateral trunk I: w/ LD		**panniculus carnosus** "similar to *Crocuta*"				**panniculus carnosus** "feebly developed" O: bicipital arch + PP	
STERNO-FACIALIS								
STERNOMASTOIDEUS	**sterno-mastoid** O: occiput + mastoid I: manubrium * 2 parts	**sterno-mastoideus + sterno-occipitalis** O: occiput + mastoid I: manubrium * 2 parts	**sterno-cleido-mastoid** O: occiput + cervical fascia I: manubrium	**sternocephalicus - sterno-occipitalis + sternomastoideus** O: occiput + mastoid process I: manubrium * 2 parts			**sternomastoideus** O: mastoid I: manubrium	**sterno-mastoid** O: mastoid w/ CM, CT I: manubrium + venetral raphe
CLEIDOMASTOIDEUS	**levator humeri proprius** O: mastoid I: clavicular intersection		**levator humeri proprius** O: mastoid I: clavicular intersection	**brachiocephalicus - cleidocephalicus - cleidomastoideus** O: mastoid process I: clavicular intersection	**cleidomastoideus** O: mastoid I: clavicular intersection	**cleidomastoideus** O: mastoid I: clavicular intersection	**cleidomastoideus** O: lateral occipital crest	**cleido-mastoid** O: mastoid w/ SM I: clavicular intersection
CLAVOTRAPEZIUS	**levator humeri proprius** O: C vertebrae I: clavicular intersection	**cleido-cervicalis / cleido-cephalicus** O: occiput + C vertebrae I: clavicular intersection, PS	**levator humeri proprius** O: C vertebrae I: clavicular intersection	**brachiocephalicus - cleidocephalicus - cleidocervicalis** O: proximal ligamentum nuchae I: clavicular intersection	**cleidocervicalis** O: ligamentum nuchae I: clavicular intersection	**cleidocervicalis** O: ligamentum nuchae I: clavicular intersection	**cephalohumeralis** O: lambdoidal crest, ligamentum nuchae I: clavicular intersection	**cephalo-humeral** I: clavicular intersection

	CARNIVORA							
	Feliforms continued			**Caniforms**				
	Hyaenidae			**Canidae**			**Ursidae**	
	Crocuta **Watson & Young, 1879**	***Hyaena*** **Spoor & Badoux, 1986a**	***Hyaena*** **Young & Robinson, 1889**	***Canis*** **Getty, 1975**	***Urocyon*** **Feeney, 1999**	***Vulpes*** **Feeney, 1999**	***Ailuropoda*** **Davis, 1964**	***Ursus*** **Kelley, 1888**
CEPHALOHUMERALIS					CT + CM / CD	CT + CM / CD	CT / CD	CT + CM + SM / CD
ACROMIOTRAPEZIUS	**trapezius** O: C5-T7 I: spine scapula	**trapezius, cervical** O: C5-T1 I: spine scapula	**trapezius** O: ligamentum nuchae + T vertebrae I: spine scapula	**trapezius** O: C3-T9 I: spine scapula	**acromiotrapezius** O: C2-T2 I: spine scapula	**acromiotrapezius** O: C2-T2 I: spine scapula	**acromiotrapezius** O: T vertebrae I: spine scapula	
DORSO-CUTANEUS								
SPINOTRAPEZIUS		**trapezius, thoracic** O: T5-8 I: spine scapula	**trapezius** somewhat separated from AT		**spinotrapezius** O: T2-9 I: spine scapula	**spinotrapezius** O: T2-9 I: spine scapula	**spinotrapezius** O: T vertebrae I: fascia of IN	
RHOMBOIDEUS CAPITIS				**r. capitis** O: occiput I: vertebral border scapula	**r. capitis** O: nuchal crest I: cranial angle scapula	**r. capitis** O: nuchal crest I: cranial angle scapula	**occipitoscapularis** O: lamboidal crest I: cranial + vertebral borders scapula	**r. capitis**
RHOMBOIDEUS CERVICIS	**rhomboideus** O: C5-T4 I: cranial border scapula	**rhomboideus** O: C5-T4 I: deep surface vertebarl border scapula	**rhomboideus** O: C5-T4 I: deep surface vertebarl border scapula	**r. cervicis** O: C2-T3 I: vertebral border scapula	**r. cervicis** O: C2-T2 I: vertebral border scapula	**r. cervicis** O: C2-T2 I: vertebral border scapula	**rhomboideus** O: lamboidal crest I: cranial angle scapula	**r. major**
RHOMBOIDEUS THORACIS				**r. thoracis** O: T3-? I: vertebral border scapula	**r. thoracis** O: T2-4 I: vertebral border scapula	**r. thoracis** O: T2-4 I: vertebral border scapula		

	CARNIVORA							
	Feliforms continued			**Caniforms**				
	Hyaenidae			**Canidae**			**Ursidae**	
	Crocuta **Watson & Young, 1879**	***Hyaena*** **Spoor & Badoux, 1986a**	***Hyaena*** **Young & Robinson, 1889**	***Canis*** **Getty, 1975**	***Urocyon*** **Feeney, 1999**	***Vulpes*** **Feeney, 1999**	***Ailuropoda*** **Davis, 1964**	***Ursus*** **Kelley, 1888**
OMOTRANSVERSARIUS "metacromion"	**levator scapulae** O: atlas I: acromion	**omotransversarius** O: atlas	**levator scapulae** O: atlas I: acromion	**omotransversarius** O: atlas I: acromion	**omotransversarius** O: atlas I: metacromion	**omotransversarius** O: atlas I: metacromion	**atlantoscapularis** O: atlas I: metacromion	**acromio-trachelien** O: atlas I: metacromion
OMOTRANSVERSARIUS								
OMOHYOIDEUS	**omo-hyoid** absent						**omohyoideus** O: hyoid + digastric (2 bellies) I: cranial angle scapula	**omo-hyoid** O: basihyoid I: cranial border scapula
SERRATUS VENTRALIS CERVICIS	 w/ SVT			**serratus ventralis cervicis** O: C2-7 I: deep surface	**levator scapulae** O: C3-7 I: cranial end deep	**levator scapulae** O: C3-7 I: cranial end deep	**levator scapulae** w/ SVT	
SERRATUS VENTRALIS THORACIS	**serratus magnus** O: C2-T1, ribs 1-8 I: vertebral border scapula	**serratus ventralis** O: C3-T3, ribs 1-8 I: deep surface scapula	**serratus magnus** "as in *Crocuta* "	**serratus ventralis thoracis** O: ribs 1-8 I: deep surface scapula	**serratus ventralis** O: ribs 1-8 I: deep surface vertebral border scapula	**serratus ventralis** O: ribs 1-8 I: deep surface vertebral border scapula	**serratus ventralis** O: C2-C7, ribs 1-9 I: deep surface vertebral border scapula	
CLAVODELTOIDEUS	**levator humeri proprius** O: clavicular intersection I: distal shaft H	**cleidobrachialis** O: clavicular intersection I: U tuberosity w/ BB	**levator humeri proprius** O: clavicular intersection I: U w/ BB	**brachiocephalicus - cleidobrachialis** O: clavicular intersection I: w/ PS deltoid tuberosity	**cleidobrachialis** O: clavicular intersection I: distal cranial H	**cleidobrachialis** O: clavicular intersection I: distal cranial H	**cephalohumeralis** O: clavicular intersection I: distal deltoid ridge H	**cephalo-humeral** O: clavicular intersection I: distal H w/ PS

	CARNIVORA							
	Feliforms continued			**Caniforms**				
	Hyaenidae			**Canidae**			**Ursidae**	
	Crocuta **Watson & Young, 1879**	***Hyaena*** **Spoor & Badoux, 1986a**	***Hyaena*** **Young & Robinson, 1889**	***Canis*** **Getty, 1975**	***Urocyon*** **Feeney, 1999**	***Vulpes*** **Feeney, 1999**	***Ailuropoda*** **Davis, 1964**	***Ursus*** **Kelley, 1888**
ACROMIODELTOIDEUS	**deltoid** O: acromion I: deltoid ridge H w/ SD	**deltoideus, acromial part** O: acromion I: deltoid tuberosity H w/ SD	**deltoid** O: acromion + fascia IN	**deltoideus pars acromialis** O: acromion I: w/ SD deltoid tuberosity	**acromiodeltoid** O: acromion I: lateral deltoid crest H	**acromiodeltoid** O: acromion I: lateral deltoid crest H	**acromiodeltoideus** O: acromion I: shaft H	
SPINODELTOIDEUS	**deltoid** O: fascia of IN I: deltoid ridge H w/ AD	**deltoideus, scapular part** O: fascia of IN I: deltoid tuberosity H w/ AD		**deltoideus pars scapularis** O: spine scapula I: w/ AD deltoid tuberosity	**spinodeltoid** O: spine scapula I: lateral deltoid crest H	**spinodeltoid** O: spine scapula I: lateral deltoid crest H	**spinodeltoideus** O: fascia IN I: shaft H w/ AD	
TERES MINOR	**teres minor** "small, distinct from IN"	**teres minor** O: caudal border scapula I: distal to GT	**teres minor** "small, distinct from IN"	**teres minor** O: caudal border scapula I: distal to GT	**teres minor** O: caudal border scapula I: proximal H distal to IN	**teres minor** O: caudal border scapula I: proximal H distal to IN	**teres minor** O: IN + caudal border scapula I: head H distal to IN	
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT		**subscapularis** O: subscapular fossa I: LT	**subscapularis (subdivided)** O: subscapular fossa I: LT	**subscapularis (subdivided)** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa (subdivided) I: distal to LT	
TERES MAJOR	**teres major** O: caudal angle scapula I: w/ LD	**teres major** O: caudal angle scapula I: medial H w/ LD		**teres major** O: caudal angle scapula I: w/ LD teres tuberosity	**teres major** O: caudal angle scapula I: w/ LD teres tuberosity	**teres major** O: caudal angle scapula I: w/ LD teres tuberosity	**teres major** O: caudal border scapula I: medial H w/ LD	**teres major** I: w/ LD
LATISSIMUS DORSI	**latissimus dorsi** O: 11T vertebrae + lumbar aponeurosis	**latissimus dorsi** O: T5-L, ilium, thoracolumbar fascia	**latissimus dorsi** O: T vertebrae, iliac crest, thoracolumbar fascia	**latissimus dorsi** O: thoracolumbar fascia, 3 ribs	**latissimus dorsi** O: T5-9, thoracolumbar fascia, ribs 9-12	**latissimus dorsi** O: T5-9, thoracolumbar fascia, ribs 9-12	**latissimus dorsi** O: T vertebrae, ribs 7-11	**latissimus dorsi** O: T vertebrae, ribs 7-11
"superficial"	I: H w/ TMA + PC	I: medial H w/ TMA	I: "as in *Crocuta*"	I: w/ TMA teres tuberosity	I: w/ TMA teres tuberosity	I: w/ TMA teres tuberosity	I: tendon of TMA	I: w/ TMA
"deep"							I: PC	

	CARNIVORA							
	Feliforms continued			Caniforms				
	Hyaenidae			Canidae			Ursidae	
	Crocuta **Watson & Young, 1879**	***Hyaena*** **Spoor & Badoux, 1986a**	***Hyaena*** **Young & Robinson, 1889**	***Canis*** **Getty, 1975**	***Urocyon*** **Feeney, 1999**	***Vulpes*** **Feeney, 1999**	***Ailuropoda*** **Davis, 1964**	***Ursus*** **Kelley, 1888**
DORSO-EPITROCHLEARIS			**dorso-epitrochlearis** O: LD	**tensor fasciae antebrachii** O: TLO I: olecranon + forearm fascia	**tensor fasciae antebrachii** O: LD I: medial olecranon	**tensor fasciae antebrachii** O: LD I: medial olecranon	**epitrochlearis** O: LD + PC I: caudo-medial olecranon	
PECTORALIS SUPERFICIALIS "clavicular"								
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis major, superficial** O: sternum I: shaft H	**pectoralis superficialis, descendant** O: manubrium I: distal H	**pectoralis major, superficial** O: sternum I: GT to distal H	**pectorales superficiales** O: sternum I: crest H	**pectoralis superficialis, transverse head** O: manubrium I: distal GT, pectoral crest H	**pectoralis superficialis, transverse head (subdivided)** O: manubrium I: distal GT, pectoral crest H	**sternohumeralis profundus** O: manubrium I: lateral H distal to GT	**pectoralis major** O: sternum + abdomen I: middle H w/ CD
PECTORALIS SUPERFICIALIS "deep"	**pectoralis major, deep** O: sternum I: shaft H	**pectoralis superficialis, transverse** O: manubrium + sternum I: proximal H	**pectoralis major, deep** O: sternum I: GT + H (2 parts)		**pectoralis superficialis, descending head** O: manubrium I: distal pectoral crest H	**pectoralis superficialis, descending head** O: manubrium I: distal pectoral crest H	**pectoralis superficialis** O: manubrium + sternum I: middle pectoral ridge H	**sterno-scapularis** O: manubrium I: GT + bicipital ridge H
PECTORALIS PROFUNDUS	**pectoralis minor** absent	**pectoralis profundus, cranial** O: sternum I: LT	**pectoralis minor** absent	**pectoralis profundus** O: sternum I: LT + GT	**pectoralis profundus** O: sternum I: GT + LT	**pectoralis profundus** O: sternum I: GT + LT	**pectoralis profundus** O: sternum I: from GT to pectoral ridge H	**pectoralis minor** O: sternum + ribs 2-7 I: GT

	CARNIVORA							
	Feliforms continued			Caniforms				
	Hyaenidae			Canidae			Ursidae	
	Crocuta **Watson & Young, 1879**	***Hyaena*** **Spoor & Badoux, 1986a**	***Hyaena*** **Young & Robinson, 1889**	***Canis*** **Getty, 1975**	***Urocyon*** **Feeney, 1999**	***Vulpes*** **Feeney, 1999**	***Ailuropoda*** **Davis, 1964**	***Ursus*** **Kelley, 1888**
PECTORALIS ABDOMINALIS		**pectoralis profundus, abdominal** O: fascia of trunk, LD I: cranial LT					**pectoralis abdominalis** O: rectus sheath I: w/ PC on PP	**pectoralis major, posterior border** O: abdominal muscles I: w/ PS
SUBCLAVIUS							**subclavius** absent	
STERNOSCAPULARIS				?PP "a superficial lateral portion tends to be somewhat separated from the main muscle"				
CORACOBRACHIALIS	**coraco-brachialis** O: glenoid I: medial H	**coracobrachialis** O: glenoid I: proximal medial H	**coraco-brachialis brevis**	**coracobrachialis** O: coracoid process I: teres tubercle	**coracobrachialis** O: coracoid process I: proximal medial H	**coracobrachialis** O: coracoid process I: proximal medial H	**coracobrachialis brevis** O: coracoid I: proximal H	**coraco-brachialis brevis** O: coracoid w/ CBl I: proximal medial H
CORACOBRACHIALIS							**coracobrachialis longus** O: coracoid I: near entepicondylar forarmen H	**coracobrachialis longus** O: coracoid w/ CBb I: near medial epicondyle
BICEPS BRACHII, short head								
BICEPS BRACHII, long head	**biceps** O: glenoid I: R + U	**biceps** O: glenoid I: R + U	**biceps** O: glenoid + coracoid I: R + U	**biceps brachii** O: supraglenoid tubercle I: R + U	**biceps brachii** O: supraglenoid tubercle I: U + R	**biceps brachii** O: supraglenoid tubercle I: U + R	**biceps brachii** O: glenoid I: tubercle R	

	CARNIVORA							
	Feliforms continued			**Caniforms**				
	Hyaenidae			**Canidae**			**Ursidae**	
	Crocuta **Watson & Young, 1879**	***Hyaena*** **Spoor & Badoux, 1986a**	***Hyaena*** **Young & Robinson, 1889**	***Canis*** **Getty, 1975**	***Urocyon*** **Feeney, 1999**	***Vulpes*** **Feeney, 1999**	***Ailuropoda*** **Davis, 1964**	***Ursus*** **Kelley, 1888**
BRACHIALIS	**brachialis anticus** O: caudal H I: U	**brachialis** O: caudal H	**brachialis anticus** I: U	**brachialis** O: sulcus brachialis I: w/ BB R	**brachialis** O: caudo-lateral H I: U	**brachialis** O: caudo-lateral H I: U	**brachialis (2 heads)** O: deltoid ridge // lateral supracondylar ridge H I: fossa cranial U	
CUBITALIS								
SUPRASPINATUS		**supraspinatus** O: supraspinous fossa I: GT		**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus (subdivided)** O: supraspinous fossa I: GT	**supraspinatus (subdivided)** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	
INFRASPINATUS		**infraspinatus** O: infraspinous fossa I: GT		**infraspinatus** O: infraspinous fossa I: near GT	**infraspinatus** O: infraspinous fossa I: fossa caudo-lateral GT	**infraspinatus** O: infraspinous fossa I: fossa caudo-lateral GT	**infraspinatus** O: infraspinous fossa I: fossa on GT	
TRICEPS BRACHII	**triceps, second**	**triceps brachii, lateral head**	**triceps, outer**	**triceps brachii, lateral head**	**triceps brachii caput lateralis**	**triceps brachii caput lateralis**	**triceps lateralis**	**triceps, outer humeral**
CAPUT LATERALE	O: proximal H I: olecranon	O: proximal lateral H I: olecranon		O: lateral H I: w/ TLO	O: tricipital line H I: lateral olecranon	O: tricipital line H I: lateral olecranon	O: lateral H + surface B I: caudo-lateral olecranon	inner humeral

	CARNIVORA							
	Feliforms continued			Caniforms				
	Hyaenidae			Canidae			Ursidae	
	Crocuta **Watson & Young, 1879**	***Hyaena*** **Spoor & Badoux, 1986a**	***Hyaena*** **Young & Robinson, 1889**	***Canis*** **Getty, 1975**	***Urocyon*** **Feeney, 1999**	***Vulpes*** **Feeney, 1999**	***Ailuropoda*** **Davis, 1964**	***Ursus*** **Kelley, 1888**
TRICEPS BRACHII CAPUT MEDIALE	**triceps, third** O: proximal H I: olecranon	**triceps brachii, medial head** O: proximal medial H I: olecranon	**triceps, inner** O: proximal medial H	**triceps brachii, medial head** O: medial H I: medial olecranon	**triceps brachii caput medialis** O: medial H I: medial olecranon	**triceps brachii caput medialis** O: medial H I: medial olecranon	**triceps medialis** O: entire caudal H (subdivided) I: medial olecranon	**triceps, innter humeral**
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps, scapular** O: caudal border scpaula I: olecranon	**triceps brachii, long head** O: caudal border scpaula I: olecranon	**triceps, long scapular**	**triceps brachii, long head** O: caudal border scapula I: caudal olecranon	**triceps brachii caput longus** O: caudal border scapula I: caudal olecranon	**triceps brachii caput longus** O: caudal border scapula I: caudal olecranon	**triceps longus, medial** O: caudal border scapula I: tip olecranon w/ TLO	anconeus
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)							**triceps longus, lateral** O: caudal border scapula I: tip olecranon w/ TLO	supinator longus
TRICEPS BRACHII ACCESSORY		**triceps brachii, accessory head** "almost fused w/ TLA"		**triceps brachii, accessory head** O: caudal neck H I: olecranon	**triceps brachii caput accessorius** O: caudal neck H I: olecranon	**triceps brachii caput accessorius** O: caudal neck H I: olecranon		

	CARNIVORA							
	Feliforms continued			**Caniforms**				
	Hyaenidae			**Canidae**			**Ursidae**	
	Crocuta **Watson & Young, 1879**	***Hyaena*** **Spoor & Badoux, 1986a**	***Hyaena*** **Young & Robinson, 1889**	***Canis*** **Getty, 1975**	***Urocyon*** **Feeney, 1999**	***Vulpes*** **Feeney, 1999**	***Ailuropoda*** **Davis, 1964**	***Ursus*** **Kelley, 1888**
ANCONEUS	**triceps, fourth** O: olecranon fossa I: olecranon	**anconeus** O: olecranon fossa H I: olecranon	**anconeus** O: olecranon fossa H I: lateral olecranon	**anconeus** O: lateral epicondylar crest I: lateral U	**anconeus** O: caudo-lateral H + caudal lateral epicondylar crest I: caudo-lateral olecranon	**anconeus** O: caudo-lateral H + caudal lateral epicondylar crest I: caudo-lateral olecranon	**anconaeus** O: distal caudal H I: olecranon	**anconeus** O: olecranon fossa I: olecranon
BRACHIORADIALIS	**supinator longus** absent	**brachioradialis** absent	**supinator longus** absent	**brachioradialis** O: lateral epicondylar crest I: R	**brachioradialis** absent	**brachioradialis** absent	**brachioradialis** O: lateral epicondylar ridge // deep surface TLA I: distal R	**supinator longus** O: supinator ridge + B (2 heads) I: distal R
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radiales longior et brevior** O: lateral supracondylar ridge H I: MC2 + 3	**ext carpi lateralis** O: lateral supracondylar ridge H	**ext carpi radiales longior et brevior** "separate throughout"	**ext carpi radialis** O: lateral epicondylar crest I: MC2 + 3	**ext carpi radialis** O: lateral epicondylar crest I: MC2 + 3	**ext carpi radialis** O: lateral epicondylar crest I: MC2 + 3	**ext carpi radialis longus** O: lateral epicondylar ridge I: MC2	
EXT CARPI RADIALIS, brevis (MC3)							**ext carpi radialis brevis** O: lateral epicondylar ridge I: MC3	
EXT DIGITORUM COMMUNIS	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext dig. communis** O: lateral supracondylar ridge H		**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondylar ridge I: digits 2, 3, 4, 5	**ext communis digitorum** "as in cat"

	CARNIVORA							
	Feliforms continued			**Caniforms**				
	Hyaenidae			**Canidae**			**Ursidae**	
	Crocuta **Watson & Young, 1879**	***Hyaena*** **Spoor & Badoux, 1986a**	***Hyaena*** **Young & Robinson, 1889**	***Canis*** **Getty, 1975**	***Urocyon*** **Feeney, 1999**	***Vulpes*** **Feeney, 1999**	***Ailuropoda*** **Davis, 1964**	***Ursus*** **Kelley, 1888**
EXT DIGITORUM LATERALIS	**ext minimi digiti** O: lateral epicondyle I: digits 4, 5 * double	**ext digitorum lateralis** O: lateral collateral ligament R + lateral epicondyle I: digits 4, 5 * 2 bellies		**ext digitorum lateralis** O: ulnar collateral ligament + R I: digits 3, 4, 5 * 2 bellies	**ext digitorum lateralis** O: lateral epicondyle + ulnar collateral ligament + R I: digits 3, 4, 5	**ext digitorum lateralis** O: lateral epicondyle + ulnar collateral ligament + R // EDC I: digits 3, 4, 5 // 3, 4 * 2 bellies	**ext digitorum lateralis** O: lateral epicondyle I: digits 4, 5	**ext minimi digiti** "as in cat"
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle		**ext carpi ulnaris** O: lateral epicondyle I: MC5 + pisiform	**ulnaris lateralis** O: lateral epicondyle I: MC5 + pisiform	**ulnaris lateralis** O: lateral epicondyle I: MC5 + pisiform	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	
SUPINATOR	**supinator brevis** O: lateral ligaments I: R	**supinator** "as in dog"	**supinator brevis** "as in *Crocuta* "	**supinator** O: lateral collateral ligament I: proximal R	**supinator** O: lateral epicondyle + lateral collateral ligament I: proximal 1/2 medial R	**supinator** O: lateral epicondyle + lateral collateral ligament I: proximal 1/3 medial R	**supinator** O: RHj I: middle lateral R	**supinator brevis** I: distal R
ABD POLLICIS LONGUS	**ext ossis metacarpi pollicis** O: medial U + R I: base rudimentary MC1	**abd digiti I longus** I: base rudimentary MC1		**abductor digiti I (pollicis) longus** O: lateral R + U I: MC1 (sesamoid)	**abd pollicis longus** O: lateral R + U I: MC1 (sesamoid)	**abd pollicis longus** O: lateral R + U I: MC1 (sesamoid)	**abd pollicis longus** O: U + R I: radial sesamoid	

	CARNIVORA							
	Feliforms continued			**Caniforms**				
	Hyaenidae			**Canidae**			**Ursidae**	
	Crocuta **Watson & Young, 1879**	***Hyaena*** **Spoor & Badoux, 1986a**	***Hyaena*** **Young & Robinson, 1889**	***Canis*** **Getty, 1975**	***Urocyon*** **Feeney, 1999**	***Vulpes*** **Feeney, 1999**	***Ailuropoda*** **Davis, 1964**	***Ursus*** **Kelley, 1888**
EXT DIGITORUM PROFUNDUS	**ext indicis** O: lateral U I: digit 2	**ext digiti II** I: EDC2	**ext indicis** O: lateral U I: digits 2, 3, 4	**ext digiti I (pollicis) et II** O: middle U I: digits 1, 2, (3)	**ext pollicis longus et indicis proprius** O: cranio-lateral U I: digit 1 + EDC2	**ext pollicis longus et indicis proprius** O: cranio-lateral U I: digit 1 + EDC2	**ext indicus proprius** O: middle U I: digits 1, 2	**ext indicis + ext secundi internodii pollicis** "fused"
EXT BREVIS DIGITORUM								
PRONATOR TERES	**pronator radii teres** O: medial epicondyle I: proximal R	**pronator teres** O: medial epicondyle I: proximal R	**pronator** "as in *Crocuta*"	**pronator teres** O: medial epicondyle I: medial R	**pronator teres** O: medial epicondyle I: proximal 1/2 medial R	**pronator teres** O: medial epicondyle I: proximal 1/3 medial R	**pronator teres** O: medial epicondyle I: distal 2/3 R	
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: base MC2	**flx carpi radialis** O: medial epicondyle		**flx carpi radialis** O: medial epicondyle I: palmar base MC2 + 3	**flx carpi radialis** O: medial epicondyle I: palmar base MC2 + 3	**flx carpi radialis** O: medial epicondyle I: palmar base MC2 + 3	**flx carpi radialis** O: medial epicondyle I: base MC2	
PALMARIS LONGUS	**palmaris longus** O: medial epicondyle I: palmar fascia	**flx digitorum superficialis** O: medial epicondyle I: digits 2f, 3f, 4f, 5f	**palmaris longus** "separate from FDS"	**flx digitorum superficialis** O: caudal medial epicondyle I: digits 2f, 3f, 4f, 5f **m**	**flx digitorum superficialis** O: caudal medial epicondyle I: digits 2f, 3f, 4f, 5f	**flx digitorum superficialis** O: caudal medial epicondyle I: digits 2f, 3f, 4f, 5f	**palmaris longus** O: medial epicondyle I: palmar aponeurosis	**flx sublimis** O: medial epicondyle I: digits 2, 3, 4, 5

	CARNIVORA							
	Feliforms continued			**Caniforms**				
	Hyaenidae			**Canidae**			**Ursidae**	
	Crocuta **Watson & Young, 1879**	***Hyaena*** **Spoor & Badoux, 1986a**	***Hyaena*** **Young & Robinson, 1889**	***Canis*** **Getty, 1975**	***Urocyon*** **Feeney, 1999**	***Vulpes*** **Feeney, 1999**	***Ailuropoda*** **Davis, 1964**	***Ursus*** **Kelley, 1888**
FLX DIGITORUM SUPERFICIALIS	**flx digitorum perforatus** O: FDP I: digits 2f, 3f, 4f, 5f	**interflexorius** O: FDP I: digits 2, 3, (4)	**flx perforatus** O: medial epicondyle I: digits 2, 3, 4, 5	**interflexorius (m)** O: FDP I: digits 2, 3, 4	**interflexorius** O: FDPe I: digits 2, 3, 4	**interflexorius** O: FDPe I: digits 2, 3, 4	**flx digitorum sublimis** O: FDPe I: digits 2, 3, 4	
INTERFLEXORII								
FLX DIGITORUM PROFUNDUS,	**flx digitorum perforans**	**flx digitorum profundus**	**flx digitorum**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx profundus**
epicondylar				O: medial epicondyle	O: distal medial epicondyle	O: distal medial epicondyle	O: medial epicondyle	O: medial epicondyle
epicondylar (FDPe)				O: medial epicondyle	O: distal medial epicondyle	O: distal medial epicondyle	O: medial epicondyle	O: medial epicondyle
epicondylar (FDPd)	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: distal medial epicondyle	O: distal medial epicondyle	O: medial epicondyle	O: medial epicondyle
ulnar	O: U	O: U	O: U	O: caudal U	O: caudal U	O: caudal U	O: U	O: U
radial	O: R + U	O: U		O: caudomedial R	O: medial R		O: proximal 2/3 R	O: R
	*I: digits 2, 3, 4, 5	*I: digits 2, 3, 4, 5		*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	
LUMBRICALES	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 3, 4	**lumbricales** O: FDP I: digits 3, 4	**lumbricales (u)** O: FDP I: medial digits 3, 4, 5	**lumbricales** O: FDP I: digits 3, 4, 5	**lumbricales** O: FDP I: digits 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** "4; usual relation"

	CARNIVORA							
	Feliforms continued			**Caniforms**				
	Hyaenidae			**Canidae**			**Ursidae**	
	Crocuta **Watson & Young, 1879**	***Hyaena*** **Spoor & Badoux, 1986a**	***Hyaena*** **Young & Robinson, 1889**	***Canis*** **Getty, 1975**	***Urocyon*** **Feeney, 1999**	***Vulpes*** **Feeney, 1999**	***Ailuropoda*** **Davis, 1964**	***Ursus*** **Kelley, 1888**
FLX CARPI ULNARIS, **epitrochlear belly** **ulnar belly**	**flx carpi ulnaris** O: medial epicondyle I: pisiform	**flx carpi ulnaris** O: medial epicondyle I: pisiform	**flx carp. ulnaris** O: medial epicondyle O: medial olecranon I: pisiform + MC5+R154	**flx carpi ulnaris** O: medial epicondyle O: U I: pisiform	**flx carpi ulnaris** O: caudal medial epicondyle O: medial olecranon I: pisiform	**flx carpi ulnaris** O: caudal medial epicondyle O: medial olecranon I: pisiform	**flx carpi ulnaris** O: distal medial epicondyle O: medial olecranon I: pisiform	**flx carpi ulnaris** O: H O: U
EPITROCHLEO-ANCONEUS							**epitrochleo-anconaeus** O: w/ TME I: medial olecranon	**epitrochleo-anconeus** "small and narrow"
PRONATOR QUADRATUS		**pronator quadratus**	**pronator quadratus** "as in *Crocuta*"	**pronator quadratus** O: U + R	**pronator quadratus** O: distal U + R	**pronator quadratus** O: distal U + R	**pronator quadratus** O: distal 1/3 U + R	
PALMARIS BREVIS							**palmaris brevis** O: pisiform I: palmar aponeurosis	
FLX DIGITORUM BREVIS MANUS		**flx digitorum brevis** O: FDS I: digit 5		**flx digitorum brevis (u)** O: deep surface PL to digit 5 I: digit 5			**flx brevis digitorum manus** absent	**flx sublimis** I: digit 5
ABD DIGITI MINIMI	**abd minimi digiti** O: pisiform I: digit 5	**abd V** O: pisiform I: digit 5	**abd minimi digiti** O: pisiform I: digit 5	**abd digiti V** O: pisiform I: digit 5 + sesamoid	**abd digiti quinti** O: pisiform I: digit 5 + sesamoid	**abd digiti quinti** O: pisiform I: digit 5 + sesamoid	**abd digiti quinti** O: pisiform I: digit 5	**abd minimi digiti** O: pisiform I: w/ EDL5

	CARNIVORA							
	Feliforms continued			**Caniforms**				
	Hyaenidae			**Canidae**			**Ursidae**	
	Crocuta **Watson & Young, 1879**	***Hyaena*** **Spoor & Badoux, 1986a**	***Hyaena*** **Young & Robinson, 1889**	***Canis*** **Getty, 1975**	***Urocyon*** **Feeney, 1999**	***Vulpes*** **Feeney, 1999**	***Ailuropoda*** **Davis, 1964**	***Ursus*** **Kelley, 1888**
ABD POLLICIS BREVIS		**abd digiti I brevis** absent		**abd digiti I (pollicis) brevis** O: carpal ligament I: sesamoid or digit 1	**abd pollicis brevis et opp pollicis** O: flx retinaculum I: digit 1	**abd pollicis brevis et opp pollicis** O: flx retinaculum I: digit 1	**abd pollicis brevis** O: radial sesamoid I: digit 1	
CONTRAHENTES	**palmar interossei** O: base MC3 + 4 I: digits 3, 5	**add digiti I** O: carpal ligament I: MC2	**add indicis, add minimi digiti (u)** O: carpus I: digit 2L, 5M	**add digiti V, add digiti II** O: carpal ligament I: medial MC5, digit 2	**add pollicis, add digiti secundi, add digiti quinti** O: flx retinaculum I: 1L, 2L, 5M	**add pollicis, add digiti secundi, add digiti quinti** O: flx retinaculum I: 1L, 2L, 5M	**add digitorum** O: carpals I: 1L, 2L, 5M	**add pollicis, add indicisl, add annularis, add minimi** I: digits 1, 2, 4, 5
FLEXOR BREVES PROFUNDUS	**interossei** 8	**interossei** 8	**flx breves** 8	**interossei + flx digiti I brevis + add digiti I** 10	**interossei + flx pollicis brevis + flx digiti quinti** 10	**interossei + flx pollicis brevis + flx digiti quinti** 10	**interossei + flx pollicis brevis + flx digiti quinti brevis** 10	**flx brevis** 10
INTERMETACARPALES							**?** extra slips of interossei?	
? Unknown homology		**pectoralis profundus, middle** O: xiphoid process I: proximal H		**flx digiti V** O: pisiform I: digit 5 + sesamoid			**opp pollicis** O: radial sesamoid I: digit 1	
? Unknown homology							**opp digiti quinti** O: unciform + pisiform I: digit 5	
RADIAL SESAMOID "PRE-POLLUX"								
ULNAR SESAMOID								

	CARNIVORA						
	Caniforms continued						
	Ailuridae	**Mustelidae**					
	Ailurus **Fisher et al., 2009**	***Lutra*** **Fisher, 1942**	***Martes*** **Feeney, 1999**	***Martes*** **Hall, 1926**	***Martes*** **Leach, 1977**	***Mephitis*** **Hall, 1926**	***Spilogale*** **Hall, 1926**
PANNICULUS CARNOSUS		**panniculus carnosus** O: LD "all-enveloping"					
STERNO-FACIALIS							
STERNOMASTOIDEUS	**sternocephalicus pars mastoidea + pars occipitalis** I: manubrium	**sternomastoideus (3 parts)** O: mastoid process + lambdoidal crest I: manubrium + clavicular intersection		**sternomastoideus** O: mastoid I: manubrium * 2 parts		**sternomastoideus** O: mastoid I: manubrium	**sternomastoideus** O: mastoid I: manubrium * 2 parts
CLEIDOMASTOIDEUS	**brachiocephalicus: cleidocephalicus pars mastoidea** O: mastoid process I: clavicular intersection	**cleidomastoideus** O: mastoid process I: clavicular intersection	**cleidomastoideus** O: mastoid I: clavicular intersection	**cleidomastoideus** O: mastoid I: clavicular intersection	**brachiocephalicus: cleidomastoid** O: mastoid I: clavicular intersection	**cleidomastoideus** O: mastoid I: clavicular intersection	**cleidomastoideus** O: mastoid I: clavicular intersection
CLAVOTRAPEZIUS	**brachiocephalicus: cleidocephalicus pars cervicalis** O: occiput - C3 I: clavicular intersection	**clavotrapezius** O: lambdoidal crest I: clavicular intersection	**cleidocervicalis** O: ligamentum nuchae I: clavicular intersection	**clavotrapezius** O: occiput I: clavicular intersection	**brachiocephalicus: cleidooccipitalis** O: nuchal crest I: clavicular intersection	**clavotrapezius** O: occiput I: clavicular intersection	**clavotrapezius** O: occiput I: clavicular intersection

	CARNIVORA						
	Caniforms continued						
	Ailuridae	**Mustelidae**					
	Ailurus **Fisher et al., 2009**	***Lutra*** **Fisher, 1942**	***Martes*** **Feeney, 1999**	***Martes*** **Hall, 1926**	***Martes*** **Leach, 1977**	***Mephitis*** **Hall, 1926**	***Spilogale*** **Hall, 1926**
CEPHALOHUMERALIS	CT + CM / CD	CT + CM + SM / CD	CT + CM / CD	CT + CM / CD		CT + CM / CD	CT + CM / CD
ACROMIOTRAPEZIUS	**trapezius pars cervicalis** O: C3-T1 I: spine scapula	**trapezius anterior** O: lamdboidal crest, C-T1 I: spine scapula	**acromiotrapezius** O: C2-T2 I: spine scapula	**acromiotrapezius** O: mid-dorsal I: spine scapula	**trapezius cervical** O: dorsal midline neck I: spine scapula	**acromiotrapezius** O: mid-dorsal I: spine scapula	**acromiotrapezius** O: mid-dorsal I: spine scapula
DORSO-CUTANEUS							
SPINOTRAPEZIUS	**trapezius pars thoracica** O: T1-7, thoracolumbar fascia I: spine scapula	**trapezius posterior** O: T1-9 I: tuberosity spine scapula	**spinotrapezius** O: T2-9 I: spine scapula	**spinotrapezius** O: T3-9 I: spine scapula	**trapezius thoracic** I: spine scapula	**spinotrapezius** O: T4-11 I: spine scapula	**spinotrapezius** O: T3-12 I: spine scapula
RHOMBOIDEUS CAPITIS		**r. capitis** O: lambdoidal crest I: cranial angle + spine scapula	**r. capitis** O: nuchal crest I: cranial angle scapula	**r. capitis** O: occiput I: vertebral border scapula	**r. capitis** O: nuchal crest I: vertebral border scapula		
RHOMBOIDEUS CERVICIS	**r. cervicis** O: C1-7 I: cranial angle + vertebral border scapula	**r. major** O: C-T vertebrae I: vertebral border scapula	**r. cervicis** O: C2-T2 I: vertebral border scapula	**r. cervicalis** O: C1-T2 I: vertebral border scapula	**r. cervicalis** O: dorsal midline, T3-4 I: vertebral border scapula	**r. cervicalis and capitis** O: C1-T6 I: vertebral border scapula	**r. cervicalis and capitis** O: C1-T6 I: vertebral border scapula
RHOMBOIDEUS THORACIS	**r. thoracis** O: T1-4 I: vertebral border scapula		**r. thoracis** O: T2-4 I: vertebral border scapula				

	CARNIVORA						
	Caniforms continued						
	Ailuridae	**Mustelidae**					
	Ailurus **Fisher et al., 2009**	***Lutra*** **Fisher, 1942**	***Martes*** **Feeney, 1999**	***Martes*** **Hall, 1926**	***Martes*** **Leach, 1977**	***Mephitis*** **Hall, 1926**	***Spilogale*** **Hall, 1926**
OMOTRANSVERSARIUS "metacromion"	**omotransversarius** O: atlas I: acromion + fascia AD	**omotrachelian** O: atlas I: metacromion	**omotransversarius** O: atlas I: metacromion	**omotrachelian** O: atlas I: metacromion	omo-transversarius	**omotrachelian** O: atlas I: metacromion	**omotrachelian** O: atlas I: metacromion
OMOTRANSVERSARIUS		**r. profundus** O: atlas I: spine scapula	**r. profundus** O: atlas I: spine scapula	**r. profundus** O: atlas I: spine scapula	**r. profundus** O: OT near atlas I: spine scapula	**r. profundus** O: atlas I: spine scapula	**r. profundus** O: atlas I: spine scapula
OMOHYOIDEUS		**omohyoideus** O: basihyoid I: subscapular fossa		**omohyoideus** O: constrictor muscles I: cranial border scapula		**omohyoideus** O: hyoid I: cranial border scapula	**omohyoideus** absent
SERRATUS VENTRALIS CERVICIS	w/ SVT	**levator anguli scapulae** w/ SVT	**levator scapulae** O: C3-7 I: deep surface cranial	**levator anguli scapulae**		**levator anguli scapulae** w/ SVT	**levator anguli scapulae**
SERRATUS VENTRALIS THORACIS	**serratus ventralis** O: C2-7, ribs 1-7 I: deep surface vertebral border scapula	**serratus magnus** O: C3-T1, ribs 1-6 I: deep surface vertebral border scapula	**serratus ventralis** O: ribs 1-8 I: deep surface cranial border scapula	**serratus magnus** O: C3-7, ribs 1-7 I: deep surface vertebral border scapula	**serratus ventralis** O: C3-7, ribs 1-7 I: deep surface vertebral border scapula	**serratus magnus** O: C2-7, ribs 1-8 I: deep surface vertebral border scapula	**serratus magnus** O: C3-7, ribs 1-8 I: deep surface vertebral border scapula
CLAVODELTOIDEUS	**brachiocephalicus: cleidobrachialis** O: clavicular intersection I: middle cranial H	**clavobrachialis** O: clavicular intersection I: deltoid ridge H	**cleidobrachialis** O: clavicular intersection I: distal cranial H	**clavodeltoideus** O: clavicle + clavicular intersection I: cranial H	**brachiocephalicus: cleidobrachialis** O: clavicular intersection I: distal lateral H	**clavodeltoideus** O: clavicle + clavicular intersection I: cranial H	**clavodeltoideus** O: clavicle + clavicular intersection I: cranial H

	CARNIVORA						
	Caniforms continued						
	Ailuridae	**Mustelidae**					
	Ailurus **Fisher et al., 2009**	***Lutra*** **Fisher, 1942**	***Martes*** **Feeney, 1999**	***Martes*** **Hall, 1926**	***Martes*** **Leach, 1977**	***Mephitis*** **Hall, 1926**	***Spilogale*** **Hall, 1926**
ACROMIODELTOIDEUS	**deltoideus pars acromialis** O: acromion I: deltoid crest H	**acromiodeltoideus** O: acromion I: proximal deltoid ridge H	**acromiodeltoid** O: acromion I: lateral deltoid crest H	**acromiodeltoideus** O: acromion I: deltoid ridge H	**deltoideus acromial** O: acromion I: deltoid crest H	**acromiodeltoideus** O: acromion I: deltoid ridge H	**acromiodeltoideus** O: acromion I: deltoid ridge H
SPINODELTOIDEUS	**deltoideus pars scapularis** O: spine scapula, fascia IN I: deltoid crest H	**spinodeltoideus** O: spine scapula I: proximal deltoid ridge H	**spinodeltoid** O: spine scapula I: lateral deltoid crest H	**spinodeltoideus** O: metacromion + spine scapula I: deltoid ridge H	**deltoideus scapular** O: metacromion + spine scapula I: deltoid crest H	**spinodeltoideus** O: metacromion + spine scapula I: deltoid ridge H	**spinodeltoideus** O: metacromion + spine scapula I: deltoid ridge H
TERES MINOR	**teres minor** O: caudal border scapula I: fossa distal to IN		**teres minor** O: caudal border scapula I: proximal H distal to IN	**teres minor** O: caudal border scapula I: GT distal to IN	**teres minor** O: caudal neck scapula I: lateral GT	**teres minor** w/ IN	**teres minor** "faintly separated from IN"
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT	**subscapularis (subdivided)** O: subscapular fossa I: LT	**subscapularis (subdivided)** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT
TERES MAJOR	**teres major** O: SS + caudal border scapula I: teres major tuberosity w/ LD	**teres major** O: SS + caudal angle scapula I: medial H w/ LD	**teres major** O: caudal angle scapula I: w/ LD teres tuberosity	**teres major** O: caudal border scapula I: medial H w/ LD	**teres major** O: teres tuberosity at caudal border scapula I: teres tuberosity proximal medial H w/ LD	**teres major** O: caudal border scapula I: medial H w/ LD	**teres major** O: caudal border scapula I: medial H w/ LD
LATISSIMUS DORSI	**latissimus dorsi** O: T4-8, ribs 9-12	**latissimus dorsi** O: T12	**latissimus dorsi** O: T2-8, thoracolumbar fascia, ribs 8-12	**latissimus dorsi** O: T4-10, ribs 11-12	**latissimus dorsi** O: T4-10, dorsal lumbar fascia	**latissimus dorsi** O: T6-11, ribs 12-14	**latissimus dorsi** O: T6-11, ribs 12-15
"superficial"	I: w/ PP	I: medial H w/ TMA	I: w/ TMA teres tuberosity	I: w/ TMA	I: teres tuberosity w/ TMA	I: w/ TMA	I: w/ TMA
"deep"	I: teres major tuberosity w/ TMA	I: pectoral ridge H w/ PC + PP		I: w/ pectoralis	I: w/ PA and PC	I: w/ pectoralis	I: w/ pectoralis

	CARNIVORA						
	Caniforms continued						
	Ailuridae	Mustelidae					
	Ailurus **Fisher et al., 2009**	*Lutra* **Fisher, 1942**	*Martes* **Feeney, 1999**	*Martes* **Hall, 1926**	*Martes* **Leach, 1977**	*Mephitis* **Hall, 1926**	*Spilogale* **Hall, 1926**
DORSO-EPITROCHLEARIS	**tensor fasciae antebrachii** O: LD + TMA I: forearm fascia w/ PC	**dorsoepitrochlearis** O: ST + LD I: fascia caudal U	**tensor fasciae antebrachii** O: LD + TMA I: medial olecranon	**epitrochlearis** O: LD + TMA I: fascia forearm	**tensor fasciae antebrachii** O: TMA + caudal angle scapula + LD I: olecranon	**epitrochlearis** O: LD I: TLO	**epitrochlearis** O: LD I: TLO
PECTORALIS SUPERFICIALIS "clavicular"							
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis superficialis** O: manubrium + sternum I: ridge H	**pectoralis major** O: manubrium + sternum I: proximal DP ridge H	**pectoralis superficialis, transverse head (subdivided)** O: manubrium I: distal GT, pectoral crest H	**pectoralis part A** O: sternum I: middle pectoral ridge H	**pectoralis, first head** O: manubrium I: middle lateral H	**pectoralis part A** O: sternum I: middle pectoral ridge H	
PECTORALIS SUPERFICIALIS "deep"	**pectoralis profundus, cranial** O: sternum I: GT	**pectoantibrachialis** O: sternum I: proximal DP ridge H	**pectoralis superficialis, descending head** O: manubrium I: distal pectoral crest H	**pectoralis part B** O: sternum I: middle pectoral ridge H	**pectoralis, second head** O: sternum I: proximal cranio-lateral H	**pectoralis part B** O: sternum I: middle pectoral ridge H	
PECTORALIS PROFUNDUS	**pectoralis profundus, caudal** O: sternum I: w/ LD fascia BB	**pectoralis minor** ? I: pectoral ridge H w/ LD + PC	**pectoralis profundus** O: sternum I: GT + LT	**pectoralis part C** O: sternum I: w/ PC, w/ LD, GHj capsule	**pectoralis, third head** O: sternum I: cranio-medial GT	**pectoralis part C** O: sternum I: w/ PC, w/ LD, GHj capsule	

	CARNIVORA						
	Caniforms continued						
	Ailuridae	Mustelidae					
	Ailurus **Fisher et al., 2009**	***Lutra*** **Fisher, 1942**	***Martes*** **Feeney, 1999**	***Martes*** **Hall, 1926**	***Martes*** **Leach, 1977**	***Mephitis*** **Hall, 1926**	***Spilogale*** **Hall, 1926**
PECTORALIS ABDOMINALIS	**pectoralis profundus, abdominal** O: fascia rectus abdominis I: w/ PP	**xiphihumeralis** O: PC + xiphisternum I: w/ PP		**pectoralis part D** O: manubrium I: GT	**pectoralis, fourth head** O: sternum I: distal cranio-medial GT	**pectoralis part D** O: manubrium I: GT	
SUBCLAVIUS							
STERNOSCAPULARIS							
CORACOBRACHIALIS	**articularis humeri** O: coracoid I: proximal caudo-medial H		**coracobrachialis** O: coracoid process I: proximal medial H	**coracobrachialis** O: coracoid process I: proximal medial H	**coracobrachialis** O: coracoid process I: H near teres tuberosity	**coracobrachialis** absent	**coracobrachialis** absent
CORACOBRACHIALIS	**coracobrachialis** O: coracoid I: cranio-medial H proximal to entepicondylar foramen		**coracobrachialis** O: coracoid process I: distal medial H	**coracobrachialis** O: coracoid process I: distal medial H	**coracobrachialis** O: coracoid process I: distal medial H near entepicondyloid foramen		
BICEPS BRACHII, short head	**biceps brachii caput breve** O: coracoid process I: R tuberosity w/ BBl						
BICEPS BRACHII, long head	**biceps brachii caput longum** O: supraglenoid tubercle I: R tuberosity w/ BBs	**biceps brachii** O: coracoid process I: R	**biceps brachii** O: supraglenoid tubercle I: R + U	**biceps brachii** O: coracoid process I: R tuberosity	**biceps brachii** O: supraglenoid tubercle I: R tuberosity	**biceps brachii** O: coracoid process I: R tuberosity	**biceps brachii** O: coracoid process I: R tuberosity

	CARNIVORA						
	Caniforms continued						
	Ailuridae	**Mustelidae**					
	Ailurus **Fisher et al., 2009**	***Lutra*** **Fisher, 1942**	***Martes*** **Feeney, 1999**	***Martes*** **Hall, 1926**	***Martes*** **Leach, 1977**	***Mephitis*** **Hall, 1926**	***Spilogale*** **Hall, 1926**
BRACHIALIS	**brachialis** O: caudo-lateral H I: proximal U	**brachialis** O: proximal lateral H I: U	**brachialis** O: caudo-lateral H I: U	**brachialis** O: lateral H I: medial U	**brachialis** O: caudo-lateral H I: medial U	**brachialis** O: lateral H I: medial U	**brachialis** O: lateral H I: medial U
CUBITALIS							
SUPRASPINATUS	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus (subdivided)** O: supraspinous fossa I: GT + GHj capsule	**supraspinatus (subdivided)** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT
INFRASPINATUS	**infraspinatus** O: infraspinous fossa I: tubercle lateral GT	**infraspinatus** O: infraspinous fossa I: tubercle lateral GT	**infraspinatus** O: infraspinous fossa I: fossa caudo-lateral GT	**infraspinatus** O: infraspinous fossa I: fossa near GT	**infraspinatus** O: infraspinous fossa I: fossa near GT	**infraspinatus** O: infraspinous fossa I: fossa near GT	**infraspinatus** O: infraspinous fossa I: fossa near GT
TRICEPS BRACHII CAPUT LATERALE	**triceps brachii caput laterale** O: caudo-lateral H neck I: cranio-lateral olecranon w/ TLO	**triceps brachii caput laterale** O: proximal caudo-lateral H I: lateral olecranon	**triceps brachii caput lateralis** O: tricipital line H I: lateral olecranon	**caput laterale of triceps brachii** O: fossa distal to head H w/ TME I: lateral olecranon	**triceps brachii lateral head** O: caudal GT I: lateral olecranon	**caput laterale of triceps brachii** O: fossa distal to head H I: lateral olecranon	**caput laterale of triceps brachii** O: fossa distal to head H I: lateral olecranon

	CARNIVORA						
	Caniforms continued						
	Ailuridae	**Mustelidae**					
	Ailurus **Fisher et al., 2009**	***Lutra*** **Fisher, 1942**	***Martes*** **Feeney, 1999**	***Martes*** **Hall, 1926**	***Martes*** **Leach, 1977**	***Mephitis*** **Hall, 1926**	***Spilogale*** **Hall, 1926**
TRICEPS BRACHII	**triceps brachii caput mediale**	**triceps brachii caput intermediale**	**triceps brachii caput medialis**	**caput mediale of triceps brachii, long head**	**triceps brachii medial head long + short portions**	**caput mediale of triceps brachii, long head**	**caput mediale of triceps brachii, long head**
CAPUT MEDIALE	O: caudo-medial H I: cranio-medial olecranon	O: caudal LT to lateral H I: olecranon	O: medial H I: medial olecranon	O: w/ TLA I: medial olecranon	O: fossa near head GT w/ TLA // caudal border scapula I: medial olecranon	O: fossa distal to head H I: medial olecranon	O: caudo-medial H I: medial olecranon
TRICEPS BRACHII	**triceps brachii caput longum**	**triceps brachii caput longus**	**triceps brachii caput longus**	**caput longum of biceps brachii**	**triceps brachii long head**	**caput longum of biceps brachii**	**caput longum of biceps brachii**
CAPUT LONGUM "tendon portion" (deep)	O: caudal border scapula I: cranio-lateral olecranon w/ TLA	O: caudal border scapula I: olecranon	O: caudal border scapula I: caudal olecranon	O: caudal border scapula O: olecranon	O: caudal border scapula I: cranial olecranon	O: caudal border scapula O: olecranon	O: caudal border scapula O: olecranon
TRICEPS BRACHII							
CAPUT LONGUM "fleshy portion" (superficial)							
TRICEPS BRACHII	**triceps brachii caput accessorium**		**triceps brachii caput accessorius**	**caput anguli of triceps brachii**	**triceps brachii angular head**	**caput anguli of triceps brachii**	**caput anguli of triceps brachii**
ACCESSORY	O: caudal H neck I: w/ TLA + TME		O: caudal neck H I: olecranon	O: caudal angle scapula I: tip olecranon	O: tendon TMA + LD I: medial olecranon	O: caudal angle scapula I: tip olecranon	O: caudal angle scapula I: tip olecranon

	CARNIVORA						
	Caniforms continued						
	Ailuridae	**Mustelidae**					
	Ailurus **Fisher et al., 2009**	***Lutra*** **Fisher, 1942**	***Martes*** **Feeney, 1999**	***Martes*** **Hall, 1926**	***Martes*** **Leach, 1977**	***Mephitis*** **Hall, 1926**	***Spilogale*** **Hall, 1926**
ANCONEUS	**anconeus** O: distal caudal H I: lateral olecranon	**anconeus externus** O: lateral supracondylar ridge H I: lateral olecranon	**anconeus** O: caudo-lateral H + caudal lateral epicondylar crest I: caudo-lateral olecranon	**anconeus** O: caudo-lateral epicondyle I: caudo-lateral olecranon	**anconeus** O: caudo-lateral epicondyle I: lateral olecranon	**anconeus** O: caudo-lateral epicondyle I: caudo-lateral olecranon	**anconeus** O: caudo-lateral epicondyle I: caudo-lateral olecranon
BRACHIORADIALIS	**brachioradialis** O: lateral supracondylar ridge H I: distal R	**brachioradialis** O: caudo-lateral H I: styloid process R	**brachioradialis** O: lateral epicondylar crest I: R	**brachioradialis** O: supracondyloid ridge H I: styloid process R	**brachioradialis** O: supracondyloid ridge H I: styloid process R	**brachioradialis** O: supracondyloid ridge H I: styloid process R	**brachioradialis** O: supracondyloid ridge H I: styloid process R
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis longus** O: lateral supracondylar ridge H I: base MC2	**ext longus carpi radialis** O: lateral supracondylar ridge H w/ ECRb I: base MC1 + 2	**ext carpi radialis** O: lateral epicondylar crest I: MC2	**ext carpi radialis longus** O: lateral supracondyloid ridge I: base MC2 + 3	**ext carpi radialis** O: lateral supracondyloid ridge I: base MC2 + 3	**ext carpi radialis longus** O: lateral supracondyloid ridge I: base MC2 + 3	**ext carpi radialis longus** O: lateral supracondyloid ridge I: base MC2 + 3
EXT CARPI RADIALIS, brevis (MC3)	**ext carpi radialis brevis** O: lateral supracondylar ridge H I: base MC3	**ext brevis carpi radialis** O: lateral supracondylar ridge H w/ ECRl I: base MC3	**ext carpi radialis** O: lateral epicondylar crest I: MC3				
EXT DIGITORUM COMMUNIS	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral supracondylar ridge H I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral supracondyloid ridge I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral supracondyloid ridge I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral supracondyloid ridge I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral supracondyloid ridge I: digits 2, 3, 4, 5

	CARNIVORA						
	Caniforms continued						
	Ailuridae	**Mustelidae**					
	Ailurus **Fisher et al., 2009**	***Lutra*** **Fisher, 1942**	***Martes*** **Feeney, 1999**	***Martes*** **Hall, 1926**	***Martes*** **Leach, 1977**	***Mephitis*** **Hall, 1926**	***Spilogale*** **Hall, 1926**
EXT DIGITORUM LATERALIS	**ext digitorum lateralis** O: lateral epicondyle + ulnar collateral ligament + R I: digits 3, 4, 5	**ext lateralis digitorum** O: lateral supracondylar ridge H I: EDC3, EDC4, EDC5	**ext digitorum lateralis** O: lateral epicondyle + ulnar collateral ligament + R I: digits 3, 4, 5	**ext digitorum lateralis** O: lateral supracondyloid ridge I: digits 3, 4, 5	**ext digitorum lateralis** O: lateral supracondyloid ridge + lateral R I: digits 3, 4, 5	**ext digitorum lateralis** O: lateral supracondyloid ridge I: digits 3, 4, 5	**ext digitorum lateralis** O: lateral supracondyloid ridge I: digits 3, 4, 5
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: caudal lateral supracondylar ridge H I: base MC5	**ulnaris lateralis** O: lateral epicondyle I: MC5 + pisiform	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ulnaris lateralis** O: lateral epicondyle + U I: base MC5 + pisiform	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5
SUPINATOR	**supinator** O: radiohumeral ligaments I: proximal cranio-medial R	**supinator** O: lateral epicondyle + head R I: proximal 2/3 cranial R	**supinator** O: lateral epicondyle + lateral collateral ligament I: proximal 3/4 medial R	**supinator** O: lateral angular ligament R I: R	**supinator** O: fossa on lateral epicondyle + lateral collateral ligament I: cranio-lateral R	**supinator** O: lateral angular ligament R I: R	**supinator** O: lateral angular ligament R I: R
ABD POLLICIS LONGUS	**abd digiti I longus** O: R + U I: base MC1 + radial sesamoid	**ext brevis pollicis** O: U + R I: base MC1	**abd pollicis longus** O: lateral R + U I: MC1 (sesamoid)	**ext pollicis brevis** O: lateral R + U I: base MC1	**abd pollicis longus** O: lateral R + U I: radial carpal + MC1	**ext pollicis brevis** O: lateral R + U I: base MC1	

	CARNIVORA						
	Caniforms continued						
	Ailuridae	**Mustelidae**					
	Ailurus **Fisher et al., 2009**	***Lutra*** **Fisher, 1942**	***Martes*** **Feeney, 1999**	***Martes*** **Hall, 1926**	***Martes*** **Leach, 1977**	***Mephitis*** **Hall, 1926**	***Spilogale*** **Hall, 1926**
EXT DIGITORUM PROFUNDUS	**ext digiti I et II** O: cranio-lateral U	**ext indicis** O: lateral U I: digit 1, EDC2	**ext pollicis longus et indicis proprius** O: cranio-lateral U I: digit 1 + EDC2	**ext indicis** O: lateral U I: digits 1, 2	**ext pollicis longus et indicis proprius** O: lateral U I: digits 1, 2	**ext indicis** O: lateral U I: digits 1, 2	
EXT BREVIS DIGITORUM			* 2 bellies				
PRONATOR TERES	**pronator teres** O: medial epicondyle I: distal 1/2 R	**pronator teres** O: medial epicondyle I: distal medial R	**pronator teres** O: medial epicondyle I: proximal 3/4 medial R	**pronator teres** O: medial epicondyle I: distal medial R	**pronator teres** O: medial epicondyle I: middle cranio-medial R	**pronator teres** O: medial epicondyle I: distal medial R	**pronator teres** O: medial epicondyle I: distal medial R
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: palmar base MC2 + 3	**flx carpi radialis** O: medial epicondyle I: base MC1	**flx carpi radialis** O: medial epicondyle I: palmar base MC2 + 3	**flx carpi radialis** O: medial epicondyle I: palmar base MC2 + 3	**flx carpi radialis** O: medial epicondyle I: palmar base MC2 + 3	**flx carpi radialis** O: medial epicondyle I: palmar base MC2 + 3	**flx carpi radialis** O: medial epicondyle I: palmar base MC2 + 3
PALMARIS LONGUS	**palmaris longus** O: medial epicondyle + FDP I: palmar fascia	**palmaris longus (2 parts)** O: medial epicondyle // PL I: digits 2f, 3f, 4f // MC5	**flx digitorum superficialis** O: caudal medial epicondyle I: digits 2f, 3f, 4f, 5f	**palmaris longus** O: distal medial epicondyle I: digits 2, 3, 4	**flx digitorum superficialis** O: FDPe + medial epicondyle I: 2f, 3f, 4f, 5f + pisiform	**palmaris longus** O: distal medial epicondyle I: digits 2, 3, 4, 5	**palmaris longus** O: distal medial epicondyle I: digits 2, 3, 4

	CARNIVORA						
	Caniforms continued						
	Ailuridae	**Mustelidae**					
	Ailurus **Fisher et al., 2009**	***Lutra*** **Fisher, 1942**	***Martes*** **Feeney, 1999**	***Martes*** **Hall, 1926**	***Martes*** **Leach, 1977**	***Mephitis*** **Hall, 1926**	***Spilogale*** **Hall, 1926**
FLX DIGITORUM SUPERFICIALIS	**flx digitorum superficialis** O: FDPs I: 2f, 3f, 4f	**flx sublimis digitorum** O: PL I: digits 2, 3, 4, 5	**interflexorius** O: FDPe I: digits 2, 3, 4	**flx digitorum sublimis** O: FDP I: 2f, 3f, 4f	**flx digitorum sublimis** O: FDPe + FDPd I: digits 2, 3, 4	**flx digitorum sublimis**	**flx digitorum sublimis**
INTERFLEXORII							
FLX DIGITORUM PROFUNDUS,	**flx digitorum profundus**	**flx profundus digitorum**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**
epicondylar	O: cranio-medial epicondyle		O: distal medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle
epicondylar (FDPe)	O: medial epicondyle	O: distal medial epicondyle	O: distal medial epicondyle	O: distal medial epicondyle	O: distal medial epicondyle	O: distal medial epicondyle	O: distal medial epicondyle
epicondylar (FDPd)	O: medial epicondyle	O: distal medial epicondyle	O: distal medial epicondyle	O: distal medial epicondyle	O: distal medial epicondyle	O: distal medial epicondyle	O: distal medial epicondyle
ulnar	O: U	O: caudo-lateral U	O: caudal U	O: caudo-medial U	O: caudo-medial U	O: caudo-medial U	O: caudo-medial U
radial	O: R + U *I: digits 1, 2, 3, 4, 5	O: R + U	O: medial R + U *I: digits 1, 2, 3, 4, 5	O: medial R + U *I: digits 1, 2, 3, 4, 5	O: cranio-medial R + U *I: digits 1, 2, 3, 4, 5	O: medial R + U *I: digits 1, 2, 3, 4, 5	O: medial R + U *I: digits 1, 2, 3, 4, 5
LUMBRICALES	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5		**lumbricales** O: FDP I: digits 3, 4, 4	**lumbricales** O: FDP I: digits 2, 3, 4, 5

	CARNIVORA						
	Caniforms continued						
	Ailuridae	**Mustelidae**					
	Ailurus **Fisher et al., 2009**	***Lutra*** **Fisher, 1942**	***Martes*** **Feeney, 1999**	***Martes*** **Hall, 1926**	***Martes*** **Leach, 1977**	***Mephitis*** **Hall, 1926**	***Spilogale*** **Hall, 1926**
FLX CARPI ULNARIS,	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**
epitrochlear belly	O: medial epicondyle	O: medial epicondyle	O: caudal medial epicondyle		O: medial epicondyle		
ulnar belly	O: caudo-medial olecranon I: pisiform	O: caudo-medial olecranon I: pisiform	O: medial olecranon I: pisiform	O: lateral olecranon I: pisiform	O: caudo-lateral olecranon I: pisiform // pisiform	O: lateral olecranon I: pisiform	O: lateral olecranon I: pisiform
EPITROCHLEO-ANCONEUS	**triceps brachii caput mediale accessorium** O: caudo-medial epicondyle I: medial olecranon	**triceps brachii caput mediale** O: medial epicondyle I: medial olecranon		**caput mediale of triceps brachii, short head** O: caudal medial epicondyle I: medial olecranon		**caput mediale of triceps brachii, short head** O: caudal medial epicondyle I: medial olecranon	**caput mediale of triceps brachii, short head** O: caudal medial epicondyle I: medial olecranon
PRONATOR QUADRATUS	**pronator quadratus** O: distal 1/3 U + R	**pronator quadratus** O: distal 1/3 U + R	**pronator quadratus** O: distal 1/3 U + R	**pronator quadratus** O: distal 1/4 U + R	**pronator quadratus** O: distal 1/4 U + R	**pronator quadratus** O: distal 1/4 U + R	**pronator quadratus** O: distal 1/4 U + R
PALMARIS BREVIS	**palmaris brevis** O: palmar fascia I: hypothenar eminence						
FLX DIGITORUM BREVIS MANUS	**flx digitorum brevis manus** O: flx retinaculum I: digit 5f			**palmaris longus part B** O: PL I: digit 5		**palmaris longus part B** O: PL I: digit 5	**palmaris longus part B** O: PL I: digit 5
ABD DIGITI MINIMI	**abd digiti V** O: pisiform I: digit 5	**abd digiti quinti** O: pisiform I: digit 5	**abd digiti quinti** O: pisiform I: digit 5 + sesamoid	**add digiti quinti** O: pisiform I: digit 5		**add digiti quinti** O: pisiform I: digit 5	**add digiti quinti** O: pisiform I: digit 5

	CARNIVORA						
	Caniforms continued						
	Ailuridae	**Mustelidae**					
	Ailurus **Fisher et al., 2009**	***Lutra*** **Fisher, 1942**	***Martes*** **Feeney, 1999**	***Martes*** **Hall, 1926**	***Martes*** **Leach, 1977**	***Mephitis*** **Hall, 1926**	***Spilogale*** **Hall, 1926**
ABD POLLICIS BREVIS	**abd et opp digiti I** O: radial sesamoid I: digit 1	**abd brevis pollicis** O: radial sesamoid + trapezium + trapezoid I: digit 1	**abd pollicis brevis et opp pollicis** O: flx retinaculum I: digit 1	**add pollicis brevis** O: flx retinaculum I: digit 1		**add pollicis brevis** O: flx retinaculum I: digit 1	**add pollicis brevis** O: flx retinaculum I: digit 1
CONTRAHENTES	**add digitorum** O: carpal ligament I: 1L, 2L, 5M	**add pollicis, add digiti secundi, add digiti quinti** O: carpals I: 1, 2, 5	**add pollicis, add digiti secundi, add digiti quinti** O: flx retinaculum I: 1L, 2L, 5M	**add pollicis, add digiti secundi, opp digiti quinti** O: carpals I: 1L, 2L, 5L		**add pollicis, add digiti secundi, add digiti quinti**	**add pollicis, add digiti secundi, add digiti quinti**
FLEXOR BREVES PROFUNDUS	**flx breves profundi** 10	**flx brevis pollicis + interosseus** 9	**interossei + flx pollicis brevis + flx digiti quinti** 10	**interossei + flx pollicis brevis + flx digiti quinti brevis** 10			
INTERMETACARPALES		**abd?** digit 2, 4					
? Unknown homology	**opp digiti V** O: flx retinaculum I: digit 5						
? Unknown homology							
RADIAL SESAMOID "PRE-POLLUX"							
ULNAR SESAMOID							

	CARNIVORA						
	Caniforms continued - (pinnipeds)						
	Procyonidae		**Odobenidae**	**Otariidae**		**Phocidae**	
	Procyon **Allen, 1882**	***Bassaricyon*** **Beddard, 1900**	***Odobenus*** **Murie, 1872d**	***Eumetopias*** **Murie, 1872d**	***Zalophus*** **Howell, 1929**	***Phoca*** **Howell, 1929**	***Phoca*** **Humphry, 1868**
PANNICULUS CARNOSUS		**musculo-cutaneous** I: H	**panniculus carnosus** O: sides + abdomen I: over deltoid and trapezius	**panniculus carnosus** O: back + sides I: w/ PS, H, over trapezius + deltoid	**panniculus carnosus** I: w/ pectoralis	**panniculus carnosus** I: over scapula	
STERNO-FACIALIS							
STERNOMASTOIDEUS			**sterno-mastoid** O: paramastoid I: sternum	**sterno-mastoid** O: paramastoid process I: manubrium	**sternomastoideus** O: occipital crest I: manubrium	**sternomastoideus** O: mastoid I: manubrium	**sterno-mastoid** O: mastoid I: sternum
CLEIDOMASTOIDEUS	**levator claviculae** O: occiput I: clavicular intersection + clavicle		**cleido-mastoid** O: paramastoid I: clavicular intersection		**cleidomastoideus** I: mastoid I: clavicular intersection	**cleidomastoideus** absent	
CLAVOTRAPEZIUS	**cephalo-humeral** O: occiput + ligamentum nuchae I: clavicular intersection	**cephalo-humeral** I: clavicular intersection	**cephalo-humeral** I: clavicular intersection	**cephalo-humeral** O: occiput I: clavicular intersection	**cephalohumeral** O: occipital crest I: clavicular intersection	**cephalohumeral** O: occipital crest I: clavicular intersection	**trapezius, foremost fibres** I: clavicular intersection

	CARNIVORA						
	Caniforms continued - (pinnipeds)						
	Procyonidae		**Odobenidae**	**Otariidae**		**Phocidae**	
	Procyon **Allen, 1882**	***Bassaricyon*** **Beddard, 1900**	***Odobenus*** **Murie, 1872d**	***Eumetopias*** **Murie, 1872d**	***Zalophus*** **Howell, 1929**	***Phoca*** **Howell, 1929**	***Phoca*** **Humphry, 1868**
CEPHALOHUMERALIS	CT + CM / CD		CT + CM / CD		CT + CM / CD	CT / CD	CT / CD
ACROMIOTRAPEZIUS	**trapezius - upper** O: occiput + ligamentum nuchae I: spine scapula	**trapezius** I: spine scapula	**trapezius, anterior** I: neck H + deltoid ridge H	**trapezius - anterior part** O: C7-T3 I: spine scapula	**humerotrapezius** O: mid dorsal vertebrae I: spine scapula + deltoid ridge H	**humerotrapezius** O: mid dorsal vertebrae I: spine scapula	**trapezius, middle fibres** I: spine scapula
DORSO-CUTANEUS							
SPINOTRAPEZIUS	**trapezius - lower** O: C7-T9 I: spine scapula		**trapezius, posterior** "as in *Eumetopias* "	**trapezius - hindermost portion** O: to T4? I: spine scapula	**spinotrapezius** O: mid dorsal I: spine scapula	**spinotrapezius** O: mid dorsal I: spine scapula	**trapezius, hinder fibres** I: posterior spine scapula
RHOMBOIDEUS CAPITIS		**r. capitis** absent	**r. capitis** I: vertebral border + spine scapula	**r. capitis** O: occiput - T4 I: vertebral border + spine scapula	**r. anticus** O: occipital crest I: spine scapula	**r. anticus** O: occiput + ligamentum nuchae I: deep surface scapula	**r. minor** O: occipital crest, ligamentum nuchae I: base spine scapula
RHOMBOIDEUS CERVICIS	**rhomboideus** O: occiput + ligamentum nuchae + T1-5 I: cranial angle scapula	**rhomboideus**					**r. major**
RHOMBOIDEUS THORACIS			**rhomboidei** I: deep surface SVT	**r. major and minor** O: T4-6 I: deep surface SVT	**r. dorsi** O: mid dorsal I: vertebral border scapula	**r. dorsi** O: mid dorsal I: vertebral border scapula	

	CARNIVORA						
	Caniforms continued - (pinnipeds)						
	Procyonidae		**Odobenidae**	**Otariidae**		**Phocidae**	
	Procyon **Allen, 1882**	***Bassaricyon*** **Beddard, 1900**	***Odobenus*** **Murie, 1872d**	***Eumetopias*** **Murie, 1872d**	***Zalophus*** **Howell, 1929**	***Phoca*** **Howell, 1929**	***Phoca*** **Humphry, 1868**
OMOTRANSVERSARIUS "metacromion"	**levator anguli scapulae** O: axis I: acromion	**omotrachelian** present	**levator claviculae** O: atlas I: spine scapula near acromion		**atlantoscapularis superior** O: atlas I: vertebral border scapula	**atlantoscapularis superior** O: atlas I: vertebral border scapula	**cervico-humeral** O: atlas I: GT
OMOTRANSVERSARIUS		**r. profundus** absent	**anterior strip r. capitis** O: occiput I: spine scapula	**levator anguli scapulae** O: atlas I: spine scapula	**atlantoscapularis inferior** O: atlas I: spine scapula	**atlantoscapularis inferior** O: atlas I: GT + deltoid ridge H	**cervico-humeral** O: atlas I:angle scapula +
OMOHYOIDEUS					**omohyoideus** O: basihyoid I: deep surface CM	**omohyoideus** absent	
SERRATUS VENTRALIS CERVICIS				O: w/ SVT	**depressor scapulae** O: C3-7 I: vertebral border	**depressor scapulae** O: C3-7 I: deep surface	**levator scapulae** O: C2-5 I: w/ SVT on deep
SERRATUS VENTRALIS THORACIS	**serratus magnus** O: C4-7, ribs 1-7 I: vertebral border scapula	**serratus magnus** O: ribs 1-7	**serratus magnus** O: ribs 1-8 I: cranial vertebral border scapula	**serratus magnus** O: C2-10, ribs 1-10 I: vertebral border scapula	**serratus magnus** O: ribs 2-10 I: vertebral border scapula	**serratus magnus** O: ribs 3-12 I: vertebral border scapula	**serratus magnus** I: deep surface vertebral border scapula
CLAVODELTOIDEUS	**cephalo-humeral** O: clavicular intersection I: cranial H, w/ PS	**cephalo-humeral** O: clavicular intersection I: H	**cephalo-humeral** O: clavicular intersection I: head H + middle deltoid ridge H	**cephalo-humeral** O: clavicular intersection I: deltoid ridge H	**cephalohumeral** O: clavicular intersection I: deltoid ridge H	**cephalohumeral** O: clavicular intersection I: LT + GT	**trapezius, foremost fibres** O: clavicular intersection I: GT + DP ridge

	CARNIVORA						
	Caniforms continued - (pinnipeds)						
	Procyonidae		Odobenidae	Otariidae		Phocidae	
	Procyon **Allen, 1882**	***Bassaricyon*** **Beddard, 1900**	***Odobenus*** **Murie, 1872d**	***Eumetopias*** **Murie, 1872d**	***Zalophus*** **Howell, 1929**	***Phoca*** **Howell, 1929**	***Phoca*** **Humphry, 1868**
ACROMIODELTOIDEUS	**deltoid** O: acromion I: H w/ SD	**deltoid**	**deltoid, second portion** O: GHj I: lateral deltoid prominence H	**deltoid, deeper second** O: GHj I: lateral deltoid prominence H			
SPINODELTOIDEUS	**deltoid** O: fascia IN I: H w/ AD	**deltoid**	**deltoid, first portion** O: spine scapula I: deltoid ridge H	**deltoid, first portion** O: spine scapula I: deltoid ridge H, slip to BR	**deltoideus** O: spine scapula I: lateral deltoid ridge H	**deltoideus** O: spine scapula I: distal deltoid crest H	**deltoid** O: supraspinous fossa + AT I: H
TERES MINOR	**teres minor** w/ IN		**teres minor** "rather indistinct"	**teres minor** O: caudal spine scapula I: lost on TLO	**teres minor** O: infraspinous fossa I: w/ SS	**teres minor** O: caudal border scapula I: w/ SD	**teres minor** O: caudal spine scapula
SUBSCAPULARIS	**subscapularis (subdivided)** O: subscapular fossa I: LT		**subscapularis (subdivided)** O: subscapular fossa I: LT	**subscapularis (subdivided)** O: subscapular fossa I: LT	**subscapularis (subdivided)** O: subscapular fossa I: LT	**subscapularis (subdivided)** O: subscapular fossa I: LT	**sub-scapularis** O: subscapular fossa I: LT
TERES MAJOR	**teres major** O: caudal border scapula I: medial bicipital groove H		**teres major** I: middle H	**teres major** O: caudal angle scapula I: middle H	**teres major** O: caudal border SS I: middle H	**teres major** O: caudal border scapula I: rugosity bicipital groove H	**teres major** O: caudal angle scapula I: H
LATISSIMUS DORSI	**latissimus dorsi** O: T1-?, ribs 12-14	**latissimus dorsi** O: last 3 ribs	**latissimus dorsi** O: last 7 ribs	**latissimus dorsi** O: T vertebrae, last 7 ribs	**latissimus dorsi** O: dorsal fascia, last rib	**latissimus dorsi** O: dorsal fascia	**latissimus dorsi** O: T verts; 2-3 ribs
"superficial"	I: medial H	I: H w/ TMA	I: H w/ PC + PP	I: medial bicipital ridge H	I: TMA + pectoralis	I: deltoid ridge H w/ pectoralis	I: w/ TMA to bicipital groove
"deep"	I: slip to pectorals		I: ?				I: bicipital ridge

	CARNIVORA						
	Caniforms continued - (pinnipeds)						
	Procyonidae		**Odobenidae**	**Otariidae**		**Phocidae**	
	Procyon **Allen, 1882**	***Bassaricyon*** **Beddard, 1900**	***Odobenus*** **Murie, 1872d**	***Eumetopias*** **Murie, 1872d**	***Zalophus*** **Howell, 1929**	***Phoca*** **Howell, 1929**	***Phoca*** **Humphry, 1868**
DORSO-EPITROCHLEARIS	**dorso-epitrochlear** O: LD I: medial olecranon	**dorso-epitrochlear + second dorso-epitrochlear** "slender + strap shaped" LD + TMA -> elbow	**dorsi epitrochlear** O: caudal angle scapula I: olecranon + fascia forearm	**dorsi epitrochlearis** O: caudal angle scapula I: tip olecranon	**epitrochlearis** O: fascia TLO + LD I: fascia forearm	**epitrochlearis** O: fascia TLO + LD I: fascia forearm	**triceps extensor cubitii** O: caudal angle scapula I: digit 5
PECTORALIS SUPERFICIALIS "clavicular"							
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis major, superficial** O: sternum I: deltoid ridge H, w/ CD	**pectoralis, anterior** O: sternum	**pectoralis major** O: manubrium + sternum I: fascia elbow + forearm	**pectoral, anterior** O: manubrium + sternum I: head to middle H	**pectoralis pars anticus** O: manubrium + sternum I: fascia forearm w/ PSd	**pectoralis pars anticus** O: manubrium + sternum I: medial deltoid ridge H	**pectoralis major (proper)** O: sternum + ribs
PECTORALIS SUPERFICIALIS "deep"	**pectoralis major, deep-seated** O: sternum + PC I: deltoid ridge H	**pectoralis** O: sternum I: H	**pectoralis minor** O: ribs + sternum I: entire shaft H	**pectoral, second division** O: ribs 1-2 + sternum I: head to middle H	**pectoralis pars posticus** O: sternum I: fascia forearm w/ PSs	**pectoralis pars posticus** I: medial deltoid ridge H	
PECTORALIS PROFUNDUS	**pectoralis minor** O: sternum I: GT	**pectoralis** O: sternum I: H	**pectoralis, third** O: manubrium I: lateral bicipital groove H	**sterno-scapular** O: manubrium I: head H	**pectoralis pars profundus** O: manubrium + sternum I: deltoid ridge H		**pectoralis minor** absent

	CARNIVORA						
	Caniforms continued - (pinnipeds)						
	Procyonidae		**Odobenidae**	**Otariidae**		**Phocidae**	
	Procyon **Allen, 1882**	***Bassaricyon*** **Beddard, 1900**	***Odobenus*** **Murie, 1872d**	***Eumetopias*** **Murie, 1872d**	***Zalophus*** **Howell, 1929**	***Phoca*** **Howell, 1929**	***Phoca*** **Humphry, 1868**
PECTORALIS ABDOMINALIS	**pannicular division** O: fascia of trunk I: "axillary tendon"				"PC is practically fused with the border of the pectoralis"	**third division** O: flanks	**pectoralis major (second division)** O: abdomen + pelvis
SUBCLAVIUS							**subclavius** O: sternum I: rib 1
STERNOSCAPULARIS							
CORACOBRACHIALIS	**coraco-brachialis** O: coracoid process I: medial H	**coracobrachialis** present	**coraco-brachialis** O: coracoid process I: distal medial H	**coraco-brachialis** absent	**coraco-brachialis** absent	**coraco-brachialis** absent	**coraco-brachialis** absent
CORACOBRACHIALIS							
BICEPS BRACHII, short head							
BICEPS BRACHII, long head	**biceps cubiti** O: coracoid process I: R tubercle	**biceps** "only long head"	**biceps** "remarkably weak"	**biceps** O: glenoid I: tuberosity R	**biceps brachii** O: rudimentary coracoid I: tuberosity R	**biceps brachii** O: rudimentary coracoid I: tuberosity R	**biceps** O: glenoid I: R

	CARNIVORA						
	Caniforms continued - (pinnipeds)						
	Procyonidae		**Odobenidae**	**Otariidae**		**Phocidae**	
	Procyon **Allen, 1882**	***Bassaricyon*** **Beddard, 1900**	***Odobenus*** **Murie, 1872d**	***Eumetopias*** **Murie, 1872d**	***Zalophus*** **Howell, 1929**	***Phoca*** **Howell, 1929**	***Phoca*** **Humphry, 1868**
BRACHIALIS	**brachialis anticus** O: lateral H I: medial U		**brachialis anticus** O: caudo-medial + lateral H I: radial tuberosity + BR	**brachialis anticus, second head** O: lateral neck H I: w/ B U	**brachialis** O: proximal lateral H I: sigmoid cavity U	**brachialis** O: lateral H I: sigmoid cavity U	**brachialis anticus** O: lateral H I: coronoid process U
CUBITALIS				**brachialis anticus, first head** O: deltoid prominence I: U			"few fibres BB passed w/ B to R"
SUPRASPINATUS	**supraspinatus** O: supraspinous fossa I: GT		**supraspinatus**	**supraspinatus (subdivided)** O: supraspinous fossa I: GT (+ LT)	**supraspinatus (subdivided)** O: supraspinous fossa I: GT + LT	**supraspinatus (subdivided)** O: supraspinous fossa I: GT + LT	**supra-spinatus** O: supraspinous fossa I: GT
INFRASPINATUS	**infraspinatus** O: infraspinous fossa I: GT		**infraspinatus** O: infraspinous fossa	**infraspinatus** O: infraspinous fossa I: fossa lateral head H	**infraspinatus** O: infraspinous fossa I: lateral base GT	**infraspinatus** O: infraspinous fossa I: GHj capsule + GT	**infra-spinatus** O: caudal scapular spine I: GT
TRICEPS BRACHII CAPUT LATERALE	**triceps, lateral humeral** O: lateral neck + caudo-medial neck H I: olecranon w/ TLO	**triceps, outer heads** O: cranial head H	**triceps** "identical to *Eumetopias*"	**triceps, second division** O: caudal H, GHj capsule I: olecranon	**triceps lateralis** O: caudo-lateral neck H I: olecranon	**triceps lateralis** O: lateral H I:	**triceps extensor cubitii** O: caudo-lateral H I: olecranon

	CARNIVORA						
	Caniforms continued - (pinnipeds)						
	Procyonidae		**Odobenidae**	**Otariidae**		**Phocidae**	
	Procyon **Allen, 1882**	***Bassaricyon*** **Beddard, 1900**	***Odobenus*** **Murie, 1872d**	***Eumetopias*** **Murie, 1872d**	***Zalophus*** **Howell, 1929**	***Phoca*** **Howell, 1929**	***Phoca*** **Humphry, 1868**
TRICEPS BRACHII CAPUT MEDIALE	**triceps, third** O: proximal medial H I: olecranon	**triceps** O: proximal H		**triceps, fourth division** O: caudal H I: olecranon	**triceps medialis** O: caudal H I: medial olecranon	**triceps medialis** O: caudal H I: medial olecranon	**triceps extensor cubitii** O: caudal H I: cranial olecranon
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps, scapula** O: scapula I: tip olecranon	**triceps, outer heads** O: caudal border scapula near glenoid		**triceps, first division** O: caudal border scapula I: olecranon	**triceps longus** O: caudal border scapula I: olecranon	**triceps longus** O: caudal border scapula I: olecranon	**triceps extensor cubitii** O: caudal border scapula I: olecranon
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)					**triceps longus** O: caudal border scapula I: olecranon	**triceps lateralis** O: caudal border scapula I: olecranon	
TRICEPS BRACHII ACCESSORY		**triceps** O: cranial head H		**triceps, third division** O: w/ TLA I: olecranon			

	CARNIVORA						
	Caniforms continued - (pinnipeds)						
	Procyonidae		**Odobenidae**	**Otariidae**		**Phocidae**	
	Procyon **Allen, 1882**	***Bassaricyon*** **Beddard, 1900**	***Odobenus*** **Murie, 1872d**	***Eumetopias*** **Murie, 1872d**	***Zalophus*** **Howell, 1929**	***Phoca*** **Howell, 1929**	***Phoca*** **Humphry, 1868**
ANCONEUS	**anconeus** O: caudal H + lateral epicondyle I: lateral olecranon	**anconeoeus** O: distal H	**anconeus externus** O: lateral epicondyle I: lateral olecranon	**anconeus externus** O: lateral epicondyle I: lateral olecranon	**anconeus externus** O: lateral supracondylar ridge H w/ TME I: lateral olecranon	**anconeus externus** O: lateral supracondylar ridge H w/ TME I: lateral olecranon	**anconeus externus** absent
BRACHIORADIALIS	**supinator longus** O: supracondyloid ridge H I: distal R		**supinator longus** O: lateral H I: styloid process R	**supinator longus** O: lateral supracondylar ridge H, slip from SD I: styloid process R	**supinator longus** O: caudo-lateral H I: distal R	**supinator longus** O: caudal H	**supinator longus** I: distal R
EXT CARPI RADIALIS, longus (MC2)	**ext carpi raidales longior et brevior** "as in man"		**ext carpi raidales longior et brevior** I: digits 1, 2	**ext carpi radialis longior** O: lateral supracondylar ridge H w/ ECRb I: MC1	**ext carpi radialis** O: lateral epicondyle I: MC1 + 2	**ext carpi radialis** O: lateral epicondyle I: MC2, 2, 3	**ext carpi radialis** O: lateral supracondylar ridge I: MC1 + 2
EXT CARPI RADIALIS, brevis (MC3)				**ext carpi radialis brevior** O: lateral supracondylar ridge H w/ ECRl I: MC2			
EXT DIGITORUM COMMUNIS	**ext communis digitorum** O: supracondyloid ridge H I: digits 2, 3, 4, 5		**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4	**common extensors, anterior portion** O: lateral epicondyle w/ EDL I: digits 2, 3, 4	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5

	CARNIVORA						
	Caniforms continued - (pinnipeds)						
	Procyonidae		**Odobenidae**	**Otariidae**		**Phocidae**	
	Procyon **Allen, 1882**	***Bassaricyon*** **Beddard, 1900**	***Odobenus*** **Murie, 1872d**	***Eumetopias*** **Murie, 1872d**	***Zalophus*** **Howell, 1929**	***Phoca*** **Howell, 1929**	***Phoca*** **Humphry, 1868**
EXT DIGITORUM LATERALIS	**ext minimi digiti** O: supracondyloid ridge H I: digits 3, 4, 5		**ext medii digiti + ext minimi digiti** O: lateral epicondyle I: digits 4 + 5, MC5 * 2 bellies	**ext medii digiti + ext minimi digiti** O: lateral epicondyle w/ EDC I: digits 3 + 4, MC5 * 2 bellies	**ext digitorum lateralis** O: lateral epicondyle I: MC4 + 5	**ext digitorum lateralis** O: lateral epicondyle I: MC2, 3, 4, 5	**ext secundus digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle I: pisiform			**ext carpi ulnaris** O: lateral olecranon I: MC5	**ext carpi ulnaris** O: lateral olecranon I: MC5	**ext carpi ulnaris** O: lateral epicondyle I: MC5	**ext carpi ulnaris** O: lateral epicondyle + U I: MC5
SUPINATOR	**supinator brevis** O: orbicular ligament I: proximal 1/3 R		**supinator brevis** O: lateral epicondyle I: distal lateral R	**supinator brevis** O: lateral epicondyle + R + U I: cranio-lateral R	**supinator brevis** O: lateral epicondyle + elbow joint capsule I: cranio-lateral R	**supinator brevis** O: lateral epicondyle + elbow joint capsule I: cranio-lateral R	**supinator brevis** O: lateral epicondyle I: cranial R
ABD POLLICIS LONGUS	**ext ossi metacarpi pollicis** O: R + U I: base MC1		**ext ossis metacarpi pollicis** O: R + interosseus space + lateral epicondyle I: digit 1	**ext ossis metacarpi pollicis** O: lateral olecranon + U I: MC1	**ext metacarpi pollicis** O: lateral U I: MC1 + digit 1	**ext metacarpi pollicis** O: lateral olecranon I: base MC1	**ext ossis metacarpi pollicis** O: lateral olecranon I: MC1

	CARNIVORA						
	Caniforms continued - (pinnipeds)						
	Procyonidae		**Odobenidae**	**Otariidae**		**Phocidae**	
	Procyon **Allen, 1882**	***Bassaricyon*** **Beddard, 1900**	***Odobenus*** **Murie, 1872d**	***Eumetopias*** **Murie, 1872d**	***Zalophus*** **Howell, 1929**	***Phoca*** **Howell, 1929**	***Phoca*** **Humphry, 1868**
EXT DIGITORUM PROFUNDUS	**ext indicis** O: lateral U I: digits 1, 2, 3		**ext primi internodii pollicis + ext secundi internodii pollicis** O: APL + R + U I: digit 1 (2 tendons)	**ext pollicis et indicis** O: lateral olecranon + U I: digit 1	**ext pollicis longus** O: fossa lateral U I: digit 1	**ext pollicis longus** O: lateral olecranon I: digit 1	**ext primi internodii pollicis** O: lateral olecranon I: digit 1
EXT BREVIS DIGITORUM				**ext primi and ext secundi internodii pollicis** absent			
PRONATOR TERES	**pronator radii teres** O: medial epicondyle I: middle R			**pronator radii teres** O: medial epicondyle I: middle R	**pronator teres** O: medial epicondyle I: R	**pronator teres** O: medial epicondyle I: R	**pronator radii teres** O: medial epicondyle I: R
FLX CARPI RADIALIS	**flx carpi radialis** O: w/ FDS I: base MC2			**flx carpi radialis** O: medial epicondyle I: MC1	**flx carpi radialis** O: medial epicondyle I: MC1 + 2	**flx carpi radialis** O: medial epicondyle I: MC1 + 2 + (3)	**flx carpi radialis** O: medial epicondyle I: MC1 + 2
PALMARIS LONGUS	**palmaris longus** "sometimes double"			**palmaris longus primus + palmaris longus secundus** O: medial epicondyle (2 bellies) I: palmar fascia	**palmaris longus** O: medial olecranon w/ FCU I: pisiform, digits 1, 5	**palmaris longus** O: medial olecranon I: digits 2, 3, 4	**palmaris longus** O: medial olecranon I: digits 2, 3, 4, R

	CARNIVORA						
	Caniforms continued - (pinnipeds)						
	Procyonidae		**Odobenidae**	**Otariidae**		**Phocidae**	
	Procyon **Allen, 1882**	***Bassaricyon*** **Beddard, 1900**	***Odobenus*** **Murie, 1872d**	***Eumetopias*** **Murie, 1872d**	***Zalophus*** **Howell, 1929**	***Phoca*** **Howell, 1929**	***Phoca*** **Humphry, 1868**
FLX DIGITORUM SUPERFICIALIS	**flx sublimis digitorum** O: FDPe I: digits 1, 2, 3, 4		**flx sublimis digitorum** O: FDP	**flx profundus digitorum** O: R + U I: digits 1, 2f, 3	**flx communis digitorum** O: medial R I: digits 1, 2, 3		**flx digitorum sublimis** O: fascia of FDP I: digits 2, 3, 4
INTERFLEXORII	**slips FDPd to FDS**						
FLX DIGITORUM PROFUNDUS, **epicondylar**	**flx profundus digitorum + flx longus pollicis**		**flx sublimis digitorum + flx pollicis longus**	**flx sublimis digitorum**	**flx communis digitorum**	**flx communis digitorum**	**flx digitorum profundus**
epicondylar (FDPe)	O: medial epicondyle		O: medial epicondyle	O: medial epicondyle + U	O: medial epicondyle + medial U I: digit 4	O: medial epicondyle	O: medial epicondyle
epicondylar (FDPd)	O: medial epicondyle w/ FCR				O: medial epicondyle I: digit 1		
ulnar	O: medial olecranon + caudomedial U		O: medial U	O: medial U	O: caudo-medial U I: digits 3, 4, 5	O: medial olecranon + U	O: U
radial	O: R (m) *I: digits 1, 2, 3, 4, 5		O: R *I: digits 1, 2, 3, 4, 5	*I: digits 2, 3, 4, 5		O: R *I: digits 1, 2, 3, 4, 5	O: R *I: dig 2, 3, 4, 5
LUMBRICALES	**lumbrical** O: FDP I: digits 1 + 2		**lumbricalis** I: digit 2	**lumbricales** absent			**lumbricales** absent

	CARNIVORA						
	Caniforms continued - (pinnipeds)						
	Procyonidae		**Odobenidae**	**Otariidae**		**Phocidae**	
	Procyon **Allen, 1882**	***Bassaricyon*** **Beddard, 1900**	***Odobenus*** **Murie, 1872d**	***Eumetopias*** **Murie, 1872d**	***Zalophus*** **Howell, 1929**	***Phoca*** **Howell, 1929**	***Phoca*** **Humphry, 1868**
FLX CARPI ULNARIS, **epitrochlear belly** **ulnar belly**	**flx carpi ulnaris (separate bellies)** O: medial epicondyle O: medial olecranon I: pisiform // pisiform		**flx carpi ulnaris + ulnar palmaris longus** I: pisiform	**flx carpi ulnaris + palmaris longus tertius** O: medial epicondyle O: olecranon I: MC5 + flx retinaculum	**flx carpi ulnaris + palmaris longus** I: pisiform	**flx carpi ulnaris + abd digiti quinti longus** O: medial olecranon O: medial olecranon I: digit 5 // pisiform + MC5	**flx carpi ulnaris** O: olecranon I: pisiform, annular ligament, F tendons
EPITROCHLEO-ANCONEUS		**epitrochleo-anconeus** present	**anconeus internus** O: medial epicondyle I: medial olecranon	**anconeus internus** O: medial epicondyle I: medial olecranon	**anconeus internus** O: medial entepicondylar ridge H I: medial olecranon	**anconeus internus** O: medial entepicondylar ridge H I: medial olecranon	
PRONATOR QUADRATUS	**pronator quadratus** O: distal 1/2 U + R		**pronator quadratus** O: R + U	**pronator quadratus** "strong interosseus ligament taking its place"	**pronator quadratus** "few fibers"	**pronator quadratus** "weak"	**pronator quadratus** "small"
PALMARIS BREVIS	**palmaris brevis** O: flx retinaculum I: base digit 5		**palmaris brevis** O: superficial fascia I: lateral digit 5				
FLX DIGITORUM BREVIS MANUS	**flx brevis minimi digiti** O: flx retinaculum I: FDP5		**flx brevis manus** O: palmar fascia I: digits 2f, 3, 4	**flx brevis minimi digiti** O: palmar fascia + pisiform I: MC5			
ABD DIGITI MINIMI	**abd minimi digiti** O: pisiform I: digit 5		**abd minimi digiti** O: palmar fascia I: digit 5	**abd minimi digiti** O: palmar fascia I: digit 5			**flx minimi digiti** O: medial epicondyle I: unciform

	CARNIVORA						
	Caniforms continued - (pinnipeds)						
	Procyonidae		**Odobenidae**	**Otariidae**		**Phocidae**	
	Procyon **Allen, 1882**	***Bassaricyon*** **Beddard, 1900**	***Odobenus*** **Murie, 1872d**	***Eumetopias*** **Murie, 1872d**	***Zalophus*** **Howell, 1929**	***Phoca*** **Howell, 1929**	***Phoca*** **Humphry, 1868**
ABD POLLICIS BREVIS							
CONTRAHENTES	**palmar interossei + opp minimi digiti** O: fascia MC I: digits 1, 2, 4, 5		**interossei, superficial layer** O: deep palmar fascia I: digit 4M	**interossei, superficial layer** O: palm ligament I: MC3M, 4M			
FLEXOR BREVES PROFUNDUS	**metacarpo-phalangeal flexors** 10		**interossei + opp pollicis** 9	**interossei, deep layer** 9			
INTERMETACARPALES							
? Unknown homology	**opp hallucis** O: sheath FCR I: MC1						
? Unknown homology							
RADIAL SESAMOID "PRE-POLLUX"							
ULNAR SESAMOID							

	Suina						
	Tayassuidae			**Suidae**			
	Pecari **Campbell, 1936**	***Pecari*** **this work**	***Pecari*** **Windle & Parsons, 1901**	***Babvrousa*** **Kneepkins et al, 1989**	***Sus*** **Campbell, 1936**	***Sus*** **Sisson, 1914**	***Sus*** **Windle & Parsons, 1901**
PANNICULUS CARNOSUS		**panniculus carnosus** O: back + sides I: fascia over shoulder; slip w/ LD		**platysma**	**panniculus carnosus** O: sides I: fascia over triceps		
STERNO-FACIALIS							
STERNOMASTOIDEUS		**sternomastoideus** O: paroccipital I: manubrium	**sterno-mastoid**		**sternocephalicus** O: occipital crest, fibrous from angle mandible I: manubrium	**sternocephalicus** O: mastoid I: sternum	**sterno-mastoid** O: paramastoid process I: sternum
CLEIDOMASTOIDEUS		**cleidomastoideus** O: paroccipital I: clavicular intersection	**cleido-mastoid**	**cleidocephalicus pars mastoidea** O: retrotympanic + paracondylar processes, tympanic bulla I: clavicular intersection	**cephalohumeralis sive brachiocephalicus** O: mastoid region I: clavicular intersection	**cleido-mastoideus** O: mastoid I: clavicular intersection	**cleido-mastoid** O: paramastoid process I: clavicular intersection
CLAVOTRAPEZIUS		**clavotrapezius** O: occipital crest I: clavicular intersection	**cephalo-humeralis**	**cleidocephalicus pars occipitalis** O: occipital crest I: clavicular intersection	**cephalohumeralis sive brachiocephalicus** O: occipital crest I: clavicular intersection	**cleido-occipitalis** O: nuchal crest I: clavicular intersection	**cephalo-humeralis** O: occipital crest
CEPHALOHUMERALIS		**(CT + CM / CD)**		**(CT + CM / CD)**	**(CT + CM / CD)**		

	Suina						
	Tayassuidae			Suidae			
	Pecari **Campbell, 1936**	***Pecari*** **this work**	***Pecari*** **Windle & Parsons, 1901**	***Babvrousa*** **Kneepkins et al, 1989**	***Sus*** **Campbell, 1936**	***Sus*** **Sisson, 1914**	***Sus*** **Windle & Parsons, 1901**
ACROMIOTRAPEZIUS		**acromiotrapezius** O: occiput, ligamentum nuchae, T1 I: fascia over S * fused w/ ST		**trapezius pars cervicalis** O: occiput, ligamentum nuchae, T1-6 I: fascia over IN	**trapezius** O: occipital crest, ligamentum nuchae, T1-13 I: fascia over S; spine scapula	**trapezius** O: occipital crest, ligamentum nuchae, T1-10 I: spine scapula	
DORSO-CUTANEUS		- -					
SPINOTRAPEZIUS		**spinotrapezius** O: T4-T10 I: middle spine scapula		**trapezius pars thoracica** O: T6-10 I: middle spine scapula			O: T1-9
RHOMBOIDEUS CAPITIS		**r. capitis** O: occiput I: w/ RC deep surface vertebral border scapula	**r. capitis**	**r. capitis** I: w/ RC deep surface vertebral border scapula	**rhomboideus, occpital part** O: occipital crest I: vertebral border scapula	**rhomboideus, cephalic part** O: occipital crest I: w/ RC	**r. capitis**
RHOMBOIDEUS CERVICIS		**r. cervicis** O: C verts I: w/ RO deep surface vertebral border scapula	**r. colli et thoracis** O: ligamentum nuchae, T1-4 I: deep surface cartilaginous portion scapula	**r. cervicis et thoracis** O: occiput, ligamentum nuchae, T1-2 I: w/ RO deep surface cartilagionous portion scapula	**rhomboideus, cervical + thoracic parts** O: C2-T4 I: vertebral border scapula	**rhomboideus, cervical part** O: C2-T6	**r. colli et thoracis** O: ligamentum nuchae, T1-4 I: deep surface cartilaginous portion scapula
RHOMBOIDEUS THORACIS		**r. thoracis** O: T1-3 I: deep surface caudal angle scap				**rhomboideus, thoracic part** O: T9-10	
OMOTRANSVERSARIUS "metacromion"		**omotransversarius** O: atlas I: fascia over IN	**omo-trachelien** O: atlas I: fascia over scapula	**omotransversarius** O: atlas I: fascia over IN	**levator scapulae ventralis** O: atlas I: fascia over S	**omo-transversarius** O: C1-2 I: spine scapula	**omo-trachelien** O: atlas I: fascia over scapula
OMOTRANSVERSARIUS							

	Suina						
	Tayassuidae			Suidae			
	Pecari **Campbell, 1936**	***Pecari*** **this work**	***Pecari*** **Windle & Parsons, 1901**	***Babyrousa*** **Kneepkins et al, 1989**	***Sus*** **Campbell, 1936**	***Sus*** **Sisson, 1914**	***Sus*** **Windle & Parsons, 1901**
OMOHYOIDEUS		**omohyoideus** ? ?	**omo-hyoid** I: scapula			**omo-hyoideus** "not connected with brachiocephalicus"	**omo-hyoid** I: C verts
SERRATUS VENTRALIS CERVICIS		**serratus ventralis cervicis** O: ?C2-7 I: cranial angle and deep surface vertebral border scapula	**levator anguli scapulae** O: C3-7	**serratus ventralis cervicis** O: C2-7 I: cranial angle and deep surface vertebral border scapula	**serratus anterior** O: C1-7 I: deep surface vertebral border scapula		**levator anguli scapulae** O: C1-7
SERRATUS VENTRALIS THORACIS		**serratus ventralis thoracis** O: ribs 1-8 I: deep surface scapula	**serratus magnus** O: ribs 1-8 I: deep surface scapula	**serratus ventralis thoracis** O: C7, ribs 1-4, ribs 4-9 I: deep surface cartilaginous portion	**serratus anterior** O: ribs 1-9 I: deep surface vertebral border scapula	**serratus ventralis** O: C1-?, ribs 1-5	**serratus magnus** O: ribs 1-7 I: deep surface scapula
CLAVODELTOIDEUS		**clavodeltoideus** O: clavicular intersection I: distal cranio-lateral H	**cephalo-humeralis** O: clavicular intersection	**cleidobrachialis** O: clavicular intersection I: distal cranio-lateral H	**cephalohumeralis sive brachiocephalicus** O: clavicular intersection I: cranial H near deltoid eminence		**cephalo-humeralis** O: clavicular intersection I: distal H
ACROMIODELTOIDEUS		**acromiodeltoideus** O: spine scapula I: lateral GT		**infraspinatus, supraspinal part** O: spine scapula I: w/ IN lateral GT	**supraspinatus** O: spine scapula I: GT		
SPINODELTOIDEUS		**spinodeltoideus** O: caudal border scapula I: proximal DP crest	**deltoid, spinous portion** O: spine scapula + fascia IN	**deltoideus** O: spine scapula I: deltoid tuberosity	**deltoideus, scapular division** O: fascia IN + caudal border scapula	**deltoid** O: fascia IN I: deltoid ridge H	**deltoid, spinous portion** O: spine scapula + fascia IN

	Suina						
	Tayassuidae			Suidae			
	Pecari **Campbell, 1936**	***Pecari*** **this work**	***Pecari*** **Windle & Parsons, 1901**	***Babvrousa*** **Kneepkins et al, 1989**	***Sus*** **Campbell, 1936**	***Sus*** **Sisson, 1914**	***Sus*** **Windle & Parsons, 1901**
TERES MINOR		**teres minor** O: caudal border scapula I: tuberosity distal GT	**teres minor** O: caudal border scapula I: GT	**teres minor** O: caudal border scapula I: teres minor tubercle	**teres minor** O: caudal border scapula I: lateral GT	**teres minor** "large and rounded" I: tubercle near lateral GT	**teres minor** O: caudal border scapula I: GT
SUBSCAPULARIS		**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: 2/3 subscapular fossa	**subscapularis** O: subscapular fossa I: LT
TERES MAJOR		**teres major** O: caudal angle I: w/ LD medial H	**teres major**	**teres major** O: caudal angle scapula I: w/LD teres major tubercle	**teres major** O: caudal angle I: w/ LD medial H	**teres major** "nothing remarkable"	**teres major**
LATISSIMUS DORSI "superficial" "deep"		**latissimus dorsi** O: thoracolumbar fascia, T9-L2, ribs 9-11 I: medial H w/ TMA	**latissimus dorsi** O: t vertebrae, 4 ribs	**latissimus dorsi** O: thoracolumbar fascia, T6-L2, ribs 9-12 I: medial H w/ TMA	**latissimus dorsi** O: T4-L, ribs 7-9 I: medial H w/ TMA	**latissimus dorsi** O: 4 ribs I: medial tuberosity H	**latissimus dorsi** O: t vertebrae, 4 ribs
DORSO-EPITROCHLEARIS		**dorso-epitrochlearis** O: LD I: medial olecranon		**tensor fasciae antebrachii** O: LD + caudal border scapula I: medial olecranon + antebrachial fascia	**dorso-epitrochlearis** O: LD + TMA I: forearm fascia, caudal olecranon	**tensor fasciae antibrachii** "as in horse"	**dorso-epitrochlearis** O: caudal border scapula + fascia IN; w/ PC I: medial olecranon
PECTORALIS SUPERFICIALIS "clavicular"							
PECTORALIS SUPERFICIALIS "superficial"		**pectoralis superficialis, superficial part** O: ? I: cranial H	**pectoralis, superficial** O: manubrium + sternum I: pectoral ridge + H	**pectorales superficiales, superficial part** O: manubrium I: cranial H	**pectoralis superficialis** O: manubrium + sternum I: cranial H		**pectoralis, superficial** O: manubrium + sternum I: pectoral ridge + H

	Suina						
	Tayassuidae			**Suidae**			
	Pecari **Campbell, 1936**	***Pecari*** **this work**	***Pecari*** **Windle & Parsons, 1901**	***Babvrousa*** **Kneepkins et al, 1989**	***Sus*** **Campbell, 1936**	***Sus*** **Sisson, 1914**	***Sus*** **Windle & Parsons, 1901**
PECTORALIS SUPERFICIALIS "deep"		**pectoralis superficialis, deep part** O: ? I: cranial H	**pectoralis, superficial** O: sternum I: fascia of forearm near elbow	**pectorales superficiales, deep part** O: sternum I: cranio-lateral H			**pectoralis, superficial** O: sternum I: fascia of forearm near elbow
PECTORALIS PROFUNDUS		**pectoralis profundus** O: ? I: GT	**pectoralis minor** O: sternum I: GHj capsule w/ PA	**pectoralis profundus** O: sternum I: GT	**pectoralis profundus** O: sternum I: GT		**pectoralis minor** O: sternum I: GHj capsule w/ PA
PECTORALIS ABDOMINALIS		**pectoralis abdominalis** O: remnant lateral thorax I: fascial sac / bursa	**pectoralis quartus** O: sternum + linea alba I: GT + PC				**pectoralis quartus** O: sternum + linea alba I: GT + PC
SUBCLAVIUS		**subclavius** absent		**subclavius** O: manubrium I: w/ PP			
STERNOSCAPULARIS		**sternoscapularis** O: ? I: fascia over S		**pectoralis profundus, most superficial layer of fibers** O: w/ PP I: fascia over S	**subclavius** O: rib 1 I: fascia over S		**subclavius + sterno-scapularis** O: manubrium + rib 1 I: fascia over supraspinatus
CORACOBRACHIALIS		**coracobrachialis medius** O: coracoid process I: medial H	**coraco-brachialis**	**coracobrachialis, pars medius** O: coracoid process I: medial H	**coracobrachialis medius** O: GHj capsule, coracoid process I: middle H	**coraco-brachialis** "undivided"	**coraco-brachialis medius** I: middle H
CORACOBRACHIALIS		**coracobrachialis profundus** O: CBm I: LT		**coracobrachialis, pars brevis** O: CBm I: distal LT	**coracobrachialis profundus** O: coracoid process + CBm I: GT? distal to SS		

	Suina						
	Tayassuidae			Suidae			
	Pecari **Campbell, 1936**	***Pecari*** **this work**	***Pecari*** **Windle & Parsons, 1901**	***Babvrousa*** **Kneepkins et al, 1989**	***Sus*** **Campbell, 1936**	***Sus*** **Sisson, 1914**	***Sus*** **Windle & Parsons, 1901**
BICEPS BRACHII, short head							
BICEPS BRACHII, long head		**biceps brachii** O: supraglenoid tubercle I: R neck	**biceps flexor longus cubiti** O: glenoid I: U	**biceps brachii** O: supraglenoid tubercle I: R + U	**biceps brachii** O: lateral coracoid I: R + U	**biceps brachii** I: R + U	**biceps flexor longus cubiti** O: coracoid I: R + U
BRACHIALIS		**brachialis (r)** O: distal to H head + lateral H I: U + R	**brachialis anticus (m)** O: caudal neck H I: U	**brachialis** O: distal to LT I: U + R	**brachialis** O: caudo-lateral H I: medial R + U	**brachialis** I: medial R + U	**brachialis anticus** O: caudal neck H I: U
CUBITALIS / **ARTICULARIS HUMERI**		**articularis humeri** O: joint capsule I: joint capsule		**articularis humeri** O: neck scapula I: joint capsule		**capsularis** "variable, frequently absent"	**subscapularis accessorius**
SUPRASPINATUS		**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT + LT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: LT	**supraspinatus** I: GT + LT	**supraspinatus** O: supraspinous fossa I: GT + LT
INFRASPINATUS		**infraspinatus** O: infraspinous fossa I: fossa on lateral GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: w/ AD lateral GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** I: GT	**infraspinatus** O: infraspinous fossa I: GT
TRICEPS BRACHII CAPUT LATERALE		**triceps brachii caput laterale** O: lateral H I: lateral olecranon		**triceps brachii caput laterale** O: lateral H I: lateral olecranon	**triceps brachii caput laterale** O: lateral H I: lateral olecranon		
TRICEPS BRACHII CAPUT MEDIALE		**triceps brachii caput mediale** O: caudo-medial H I: medial 1/2 cranial olecranon		**triceps brachii caput mediale** O: caudo-medial H I: medial 1/2 cranial olecranon	**triceps brachii caput mediale** O: proximal H, two heads I: proximal olecranon		

	Suina						
	Tayassuidae			Suidae			
	Pecari **Campbell, 1936**	***Pecari*** **this work**	***Pecari*** **Windle & Parsons, 1901**	***Babvrousa*** **Kneepkins et al, 1989**	***Sus*** **Campbell, 1936**	***Sus*** **Sisson, 1914**	***Sus*** **Windle & Parsons, 1901**
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)		**triceps brachii caput longum** O: neck of scapula I: caudo-medial tip of olecranon		**triceps brachii caput longum** O: caudal border scapula I: olecranon	**triceps brachii caput longum, medial division** O: near glenoid on caudal border scapula I: w/ TLO distal olecranon		
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)		**triceps brachii caput longum** O: caudal border scapula I: caudo-medial tip of olecranon		**triceps brachii caput longum** "no division into 2 or 3 portions"	**triceps brachii caput longum, lateral division** O: caudal border scapula I: w/ TLO distal olecranon		
TRICEPS BRACHII ACCESSORY		- - -			**triceps brachii caput longum, thid division** O: near glenoid on caudal border scapula I: w/ TLO distal olecranon		
ANCONEUS		**anconeus** O: caudo-lateral H w/ TME I: lateral 1/2 cranial olecranon		**anconeus** O: caudal H + medial + lateral epicondylar crests I: w/ TME + lateral olecranon	**triceps anconeus** O: distal caudal H I: medial olecranon		
BRACHIORADIALIS		**brachioradialis** absent	**supinator longus** absent	**brachioradialis** absent	**brachioradialis** absent		**supinator longus** absent
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis** O: lateral epicondyle I: base MC3	**ext carpi radialis** O: lateral supracondylar crest I: base MC3	**ext carpi radiales longior & brevior**	**ext carpi radialis** O: lateral supracondylar crest I: MC2, MC4	**ext carpi radialis** O: lateral epicondyle I: base MC3, slip MC4	**ext carpi radialis** I: MC3	**ext carpi radiales longior & brevior** I: MC3
EXT CARPI RADIALIS, brevis (MC3)							

	Suina						
	Tayassuidae			Suidae			
	Pecari **Campbell, 1936**	***Pecari*** **this work**	***Pecari*** **Windle & Parsons, 1901**	***Babvrousa*** **Kneepkins et al, 1989**	***Sus*** **Campbell, 1936**	***Sus*** **Sisson, 1914**	***Sus*** **Windle & Parsons, 1901**
EXT DIGITORUM COMMUNIS	**ext digitorum communis** O: lateral epicondyle I: digit 2, 3, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 3, 4, MC3+4	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 3, 4, 4, 5	**ext digitorum communis, caput mediale, caput intermedium, caput laterale** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle + R I: digit 2, 3, 3, 4, 5	**common digital extensor** O: lateral epicondyle + ligament elbow I: digit 2, 3, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5
EXT DIGITORUM LATERALIS	**ext digitorum lateralis** O: lateral epicondyle + U I: digits 4+5 * two bellies	**ext digitorum lateralis** O: lateral epicondyle + U I: digits 4+5, MC5 * two bellies	**ext minimi digiti** O: lateral epicondyle	**ext digitorum lateralis, caput craniale, caput caudale** O: lateral epicondyle I: digits 4+5 * two bellies	**ext digitorum lateralis** O: lateral epicondyle + U I: digits 4+5 * two bellies	**lateral digital extensor** I: digits 4, 5 // 5 * two bellies	**ext minimi digiti** O: lateral epicondyle I: digits 4+5
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle I: pisiform, hamate, base MC4+5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle	**ext carpi ulnaris** O: lateral epicondyle I: pisiform + base MC5	**ext carpi ulnaris** O: lateral epicondyle I: pisiform, base MC5	**ulnaris lateralis** O: lateral epicondyle I: pisiform	**ext carpi ulnaris** O: lateral epicondyle
SUPINATOR		**supinator** absent	**supinator brevis** absent	**supinator** absent		**supinator** O: lateral R I: w/ FDPr	**supinator brevis** absent
ABD POLLICIS LONGUS	**abd pollicis longus** O: distal U + R I: base MC2	**abd pollicis longus** O: distal U I: base MC2	**ext ossis metacarpi pollicis**	**abd pollicis longus** O: distal U + R I: MC2	**abd pollicis longus** O: distal U + R I: base MC2	**ext carpi obliquus** O: distal R + U I: MC2	**ext ossis metacarpi pollicis** O: U + R I: MC2
EXT DIGITORUM PROFUNDUS		**ext digitorum profundus** O: U I: digit 2		**ext digiti II** O: U I: digit 2 + MC3			**ext profundus digitorum** I: digits 2 + 3
EXT BREVIS DIGITORUM							

	Suina						
	Tayassuidae			Suidae			
	Pecari **Campbell, 1936**	***Pecari*** **this work**	***Pecari*** **Windle & Parsons, 1901**	***Babvrousa*** **Kneepkins et al, 1989**	***Sus*** **Campbell, 1936**	***Sus*** **Sisson, 1914**	***Sus*** **Windle & Parsons, 1901**
PRONATOR TERES		**pronator teres** O: medial epicondyle I: distal cranial R	**pronator teres**	**pronator teres** O: medial epicondyle I: distal cranial R	**pronator teres** O: medial epicondyle I: distal R	**pronator teres** O: medial epicondyle I: middle R	**pronator teres**
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: palmar base MC2	**flx carpi radialis** O: medial epicondyle I: palmar base MC3	**flx carpi radialis** O: medial epicondyle	**flx carpi radialis** O: medial epicondyle I: palmar base MC3	**flx carpi radialis** O: medial epicondyle I: palmar base MC2	**flx carpi radialis** O: medial epicondyle I: MC3	**flx carpi radialis** O: medial epicondyle
PALMARIS LONGUS		**palmaris longus** O: medial epicondyle + FDPe I: digit 4f	**palmaris longus** absent	**flx digitorum superficialis** O: medial epicondyle I: digit 3f+4	**flx digitorum sublimis** O: medial epicondyle I: digit 4f	**superficial digital flexor, superficial head** O: medial epicondyle I: digit 4f	**palmaris longus** absent
FLX DIGITORUM SUPERFICIALIS	**flx digitorum sublimis** O: medial epicondyle I: digit 3f, 4f	**flx digitorum superficialis** O: FDPd I: digit 3f	**flx sublimis digitorum**	**interflexorius profundo-sublimis** O: FDP I: digit 3	**flx digitorum sublimis (m)** O: medial epicondyle I: digit 3f	**superficial digital flexor, deep head** O: medial epicondyle I: digit 3f	**flx sublimis digitorum** I: digits 3, 4
INTERFLEXORII	**medio-proximale of Verbindung, interflexorius sublimi-profundus of Kajava**	**contribution from FDPr**		**interflexorius sublimi-profundus + medio-proximale Verbindung**	**medio-proximale of Verbindung, interflexorius sublimi-profundus of Kajava**	**FDS - FDP**	

	Suina						
	Tayassuidae			Suidae			
	Pecari **Campbell, 1936**	***Pecari*** **this work**	***Pecari*** **Windle & Parsons, 1901**	***Babvrousa*** **Kneepkins et al, 1989**	***Sus*** **Campbell, 1936**	***Sus*** **Sisson, 1914**	***Sus*** **Windle & Parsons, 1901**
FLX DIGITORUM PROFUNDUS,		**flx digitorum profundus**	**flx profundus digitorum**	**flx digitorum profundus, caput humerale, caput radiale, caput ulnare**	**flx digitorum profundus**	**deep digital flexor**	**flx profundus digitorum**
epicondylar							O: medial epicondyle
epicondylar (FDPe)	O: distal medial epicondyle	O: distal medial epicondyle		O: distal medial epicondyle	O: distal medial epicondyle (m+u)	O: medial epicondyle	O: medial epicondyle
epicondylar (FDPd)	O: distal medial epicondyle	O: distal medial epicondyle		O: distal medial epicondyle	O: distal medial epicondyle (m+u)	O: medial epicondyle	O: medial epicondyle
ulnar	O: medial olecranon	O: medial olecranon		O: medial olecranon	O: medial olecranon (u)	O: medial U	O: medial olecranon
radial	O: medial R *I: dig 2, 3, 4, 5	O: medial R *I: dig 3, 4, 5		O: medial R *I: dig 2, 3, 4, 5	O: medial R *I: dig 2, 3, 4, 5	O: medial R *I: dig 2, 3, 4, 5	O: R
LUMBRICALES	**lumbricales manus** absent	**lumbricales** O: FDP tendon I: fibers 3, 4	**lumbricales**	**lumbricales** absent	**lumbricales manus** O: FDP tendon I: medial digit 2	**lumbricales manus** O: FDP tendon I: digit 2	**lumbricales** I: digit 2
FLX CARPI ULNARIS,	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**
epitrochlear belly		O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle
ulnar belly		-		-	-	-	
	I: pisiform	I: pisiform		I: pisiform	I: pisiform	I: pisiform	
EPITROCHLEO-ANCONEUS		**epitrochleo-anconeus** absent					
PRONATOR QUADRATUS		**pronator quadratus** absent	**pronator quadratus** absent	**pronator quadratus** absent			**pronator quadratus** absent

	Suina						
	Tayassuidae			Suidae			
	Pecari **Campbell, 1936**	***Pecari*** **this work**	***Pecari*** **Windle & Parsons, 1901**	***Babvrousa*** **Kneepkins et al, 1989**	***Sus*** **Campbell, 1936**	***Sus*** **Sisson, 1914**	***Sus*** **Windle & Parsons, 1901**
PALMARIS BREVIS		**palmaris brevis** absent					
FLX DIGITORUM BREVIS MANUS	**flx brevis manus** absent	**flx digitorum breves manus** absent	**flx brevis digitorum manus**	**flx digitorum brevis** absent	**flx brevis manus** absent		**flx brevis digitorum manus**
ABD DIGITI MINIMI	**abd digiti quinti manus** absent	**abd digiti minimi** absent	**abd minimi digiti** O: pisiform		**abd digiti quinti manus** O: pisiform I: lateral digit 5	**abd fifth digit** present	**abd minimi digiti** O: pisiform
ABD POLLICIS BREVIS		**abd pollicis brevis** absent					
CONTRAHENTES	**contrahentes digitorum manus** O: carpus I: digits 2+5	**contrahentes** O: carpus I: digits 2+5		**abd [sic] digiti II, add digiti V** O: carpus I: digits 2, 5	**contrahentes digitorum manus** O: capitate + hamate I: digits 2+5	**add second and fifth digits** I: digits 2+5	**oblique adductor muscles** I: digits 2, 5
FLEXOR DIGITORUM BREVES PROFUNDUS	**flx breves profundi manus** 8	**flx digitorum breves profundus** 8 O: carpus	**interossei or flexores breves**	**abd + interosseus digiti II, interosseus digiti III, IV, abd + flx + interosseus digiti V** 8 O: carpus	**flx breves profundi manus** 5	**interossei** 6?	**interossei or flexores breves** 8
INTERMETACARPALES							
RADIAL SESAMOID "PRE-POLLUX"		present - in flx retinaculum					
ULNAR SESAMOID **CARPAL VIBRISSAE**		present - base MC5					

	Ruminantia						
	Tragulidae		Antilocapridae	Giraffidae			Cervidae
	Tragulus **this work**	***Tragulus*** **Windle & Parsons, 1901**	***Antilocapra*** **Beddard, 1909**	***Giraffa*** **Owen, 1838**	***Giraffa*** **Murie, 1872c**	***Giraffa*** **Windle & Parsons, 1901**	***Mazama*** **Windle & Parsons, 1901**
PANNICULUS CARNOSUS	**panniculus carnosus** O: back + sides I: fascia at axilla; slip w/ LD, PA/PP		**panniculus carnosus** I: w/ LD				
STERNO-FACIALIS							
STERNOMASTOIDEUS	**sternomastoideus** O: paroccipital, fasica of masseter I: sternum	**sterno-mastoid** O: fascia over masseter, paramastoid I: ventral raphe		**sterno-mastoideus / sterno-maxillaris** O: angle of mandible I: sternum		**sterno-mastoid** O: angle of mandible	**sterno-mastoid** O: fascia over masseter, paramastoid
CLEIDOMASTOIDEUS	**cleidomastoideus** O: paroccipital I: clavicular intersection	**cleido-mastoid** I: clavicular intersection				**cleido-mastoid**	**cleido-mastoid** I: clavicular intersection
CLAVOTRAPEZIUS	**clavotrapezius** O: occipital crest I: clavicular intersection	**cephalo-humeralis** O: occipital crest		**trapezius** O: C5-6	**cephalo-humeral** O: C5-6 I: clavicular intersection	**cephalo-humeralis** O: C5-6 I: clavicular intersection	**cephalo-humeralis** O: occipital crest
CEPHALOHUMERALIS	**(CT + CM / CD)**						

	Ruminantia						
	Tragulidae		Antilocapridae	Giraffidae			Cervidae
	Tragulus **this work**	***Tragulus*** **Windle & Parsons, 1901**	***Antilocapra*** **Beddard, 1909**	***Giraffa*** **Owen, 1838**	***Giraffa*** **Murie, 1872c**	***Giraffa*** **Windle & Parsons, 1901**	***Mazama*** **Windle & Parsons, 1901**
ACROMIOTRAPEZIUS	**acromiotrapezius** O: occiput, ligamentum nuchae, T1-2 I: spine scapula, fascia over S			**trapezius** O: ligamentum nuchae I: fascia over scapula	**trapezius** O: distal neck		
DORSO-CUTANEUS	- -						
SPINOTRAPEZIUS	**spinotrapezius** O: T3-T13 I: base spine scapula						
RHOMBOIDEUS CAPITIS	**r. capitis** O: occiput I: w/ RC deep surface vertebral border scapula	**r. capitis** absent				**r. capitis** absent	**r. capitis** absent
RHOMBOIDEUS CERVICIS	**r. cervicis** O: C verts I: w/ RO deep surface vertebral border scapula	**r. colli et thoracis** O: ligamentum nuchae, T1-4 I: deep surface cartilaginous portion scapula	**rhomboidei; superficial** I: cartilage of scapula	**rhomboideus** I: cartilage of scapula	**rhomboideus** O: C7-T3	**r. colli et thoracis** O: ligamentum nuchae, T1-2 I: deep surface cartilaginous portion scapula	**r. colli et thoracis** O: ligamentum nuchae, T1-4 I: deep surface cartilaginous portion scapula
RHOMBOIDEUS THORACIS	**r. thoracis** O: T1-3 I: deep surface vertebral border scapula		**rhomboidei; deep** I: cartilage of scapula				
OMOTRANSVERSARIUS "metacromion"	**omotransversarius** O: atlas I: fascia over SD	**omo-trachelien**				**omo-trachelien** O: C6-7	**omo-trachelien** absent
OMOTRANSVERSARIUS							

	Ruminantia						
	Tragulidae		Antilocapridae	Giraffidae			Cervidae
	Tragulus **this work**	***Tragulus*** **Windle & Parsons, 1901**	***Antilocapra*** **Beddard, 1909**	***Giraffa*** **Owen, 1838**	***Giraffa*** **Murie, 1872c**	***Giraffa*** **Windle & Parsons, 1901**	***Mazama*** **Windle & Parsons, 1901**
OMOHYOIDEUS	**omohyoideus** O: hyoid I: fascia of S	**omo-hyoid** I: fascia over carotid artery		**omo-hyoideus** O: hyoid I: C3		**omo-hyoid** I: fascia over carotid artery	**omo-hyoid** I: fascia over carotid artery
SERRATUS VENTRALIS CERVICIS	**serratus ventralis cervicis** O: C1-7 I: cranial border scapula	**levator anguli scapulae** O: C2-7		**levator scapulae** O: C5-7 I: cranial angle scapula	**levator anguli scapulae** O: C5-7	**levator anguli scapulae** O: C5-7	**levator anguli scapulae** O: C3-7
SERRATUS VENTRALIS THORACIS	**serratus ventralis thoracis** O: ribs 1-9 I: deep surface scapula	**serratus magnus** O: ribs 1-10 I: deep surface scapula	**serratus** O: ribs 1-8 I: scapula	**serratus major** I: cartilage of scapula	**serratus magnus** O: ribs 1-11 I: cartilage of scapula + scapula	**serratus magnus** O: ribs 1-11 I: deep surface scapula	**serratus magnus** O: ribs 1-8 I: deep surface scapula
CLAVODELTOIDEUS	**clavodeltoideus** O: clavicular intersection I: distal cranial H	**cephalo-humeralis** O: clavicular intersection I: distal H	**clavicular portion of deltoid** O: clavicular intersection		**cephalo-humeral** O: clavicular intersection I: H	**cephalo-humeralis** O: clavicular intersection I: distal H	**cephalo-humeralis** O: clavicular intersection
ACROMIODELTOIDEUS	**acromiodeltoideus** O: acromion I: w/ SD	**deltoid, acromial part** O: acromion					
SPINODELTOIDEUS	**spinodeltoideus** O: spine scapula + fascia IN I: cranial H	**deltoid, spinous portion** O: spine scapula + fascia IN	**spinous portion of deltoid** O: spine scapula + fascia IN			**deltoid, spinous portion** O: spine scapula + fascia IN	**deltoid, spinous portion** O: spine scapula + fascia IN

	Ruminantia						
	Tragulidae		Antilocapridae	Giraffidae			Cervidae
	Tragulus **this work**	***Tragulus*** **Windle & Parsons, 1901**	***Antilocapra*** **Beddard, 1909**	***Giraffa*** **Owen, 1838**	***Giraffa*** **Murie, 1872c**	***Giraffa*** **Windle & Parsons, 1901**	***Mazama*** **Windle & Parsons, 1901**
TERES MINOR	**teres minor** O: neck scapula I: lateral GT	**teres minor** O: caudal border scapula I: GT	**teres minor** I: deep to SD		**teres minor** I: fossa on distal GT	**teres minor** O: caudal border scapula I: GT	**teres minor** O: caudal border scapula I: GT
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis (subdivided)** O: subscapular fossa			**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT
TERES MAJOR	**teres major** O: caudal angle I: w/ LD medial H	**teres major**	**teres major** I: w/ LD medial H		**teres major** I: w/ LD medial H	**teres major**	**teres major**
LATISSIMUS DORSI "superficial" "deep"	**latissimus dorsi** O: thoracolumbar fascia, T5-L1 I: medial H w/ TMA	**latissimus dorsi** O: T9-13, ribs	**latissimus dorsi** O: T verts, ribs 9-11 I: medial H w/ TMA		**latissimus dorsi** O: 4 ribs I: H w/ TMA	**latissimus dorsi** O: ?, ribs	**latissimus dorsi**
DORSO-EPITROCHLEARIS	**dorso-epitrochlearis** O: TMA I: medial olecranon	**dorso-epitrochlearis** O: IN / LD	**dorso-epitrochlear** O: LD I: medial olecranon		**dorso-epitrochlear**		**dorso-epitrochlearis** O: LD
PECTORALIS SUPERFICIALIS "clavicular"							
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis superficialis, superficial part** O: manubrium + sternum I: distal cranial H	**pectoralis, superficial** O: manubrium + sternum I: pectoral ridge + H		**p. major** O: sternum I: fascia forearm extensors	**p. major**	**pectoralis, superficial** O: manubrium + sternum I: pectoral ridge + H	**pectoralis, superficial** O: manubrium + sternum I: pectoral ridge + H

	Ruminantia						
	Tragulidae		Antilocapridae	Giraffidae			Cervidae
	Tragulus **this work**	***Tragulus*** **Windle & Parsons, 1901**	***Antilocapra*** **Beddard, 1909**	***Giraffa*** **Owen, 1838**	***Giraffa*** **Murie, 1872c**	***Giraffa*** **Windle & Parsons, 1901**	***Mazama*** **Windle & Parsons, 1901**
PECTORALIS SUPERFICIALIS "deep"	**pectoralis superficialis, deep part** O: manubrium + sternum I: distal cranial H	**pectoralis, superficial** O: sternum I: fascia of forearm near elbow				**pectoralis, superficial** O: sternum I: fascia of forearm near elbow	**pectoralis, superficial** O: sternum I: fascia of forearm near elbow
PECTORALIS PROFUNDUS	**pectoralis profundus + abominalis** O: xiphisternum, thorax, abdomen I: GT	**pectoralis minor** O: sternum I: GHj capsule w/ PA		**p. major, deep** O: sternum I: fascia forearm flexors	**p. minor**	**pectoralis minor** O: sternum I: GHj capsule w/ PA	**pectoralis minor** O: sternum I: GHj capsule w/ PA
PECTORALIS ABDOMINALIS		**pectoralis quartus** O: sternum + linea alba I: GT + PC				**pectoralis quartus** O: sternum + linea alba I: GT + PC	**pectoralis quartus** O: sternum + linea alba I: GT + PC
SUBCLAVIUS	**subclavius** absent						
STERNOSCAPULARIS	**sternoscapularis** O: sternum I: fascia over S	**subclavius + sterno-scapularis** O: manubrium + rib 1 I: fascia over supraspinatus					**subclavius + sterno-scapularis** O: manubrium + rib 1 I: fascia over supraspinatus
CORACOBRACHIALIS	**coracobrachialis medius** O: coracoid process I: cranio-medial H	**coraco-brachialis** I: middle H			**coraco-brachialis, shorter** I: H neck	**coraco-brachialis brevis** I: proximal H	**coraco-brachialis** I: middle H
CORACOBRACHIALIS	**coracobrachialis profundus** O: CBm I: cranio-medial H				**coraco-brachialis, longer** I: distal H	**coraco-brachialis longus** I: distal H	

	Ruminantia						
	Tragulidae		Antilocapridae	Giraffidae			Cervidae
	Tragulus **this work**	***Tragulus*** **Windle & Parsons, 1901**	***Antilocapra*** **Beddard, 1909**	***Giraffa*** **Owen, 1838**	***Giraffa*** **Murie, 1872c**	***Giraffa*** **Windle & Parsons, 1901**	***Mazama*** **Windle & Parsons, 1901**
BICEPS BRACHII, short head							
BICEPS BRACHII, long head	**biceps brachii** O: supraglenoid tubercle I: R neck	**biceps flexor longus cubiti** O: glenoid I: R	**biceps brachii** O: coracoid process		**biceps** I: U	**biceps flexor longus cubiti** O: coracoid + glenoid I: R or U	**biceps flexor longus cubiti** O: glenoid I: U
BRACHIALIS	**brachialis** O: distal to GT + caudo-lateral H I: medial U	**brachialis anticus** O: caudal neck H	**brachialis anticus** I: U		**brachialis anticus** I: U	**brachialis anticus** O: caudal neck H	**brachialis anticus** O: caudal neck H
CUBITALIS / **ARTICULARIS HUMERI**							
SUPRASPINATUS	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT + LT	**supraspinatus** O: supraspinous fossa I: GT + LT		**supraspinatus** O: supraspinous fossa I: GT + LT	**supraspinatus** O: supraspinous fossa I: GT + LT	**supraspinatus** O: supraspinous fossa I: GT + LT
INFRASPINATUS	**infraspinatus** O: infraspinous fossa I: fossa on lateral GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa		**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT
TRICEPS BRACHII CAPUT LATERALE	**triceps brachii caput laterale** O: proximal caudo-lateral H I: lateral + caudal olecranon		**triceps, external head** O: lateral H		**triceps**		
TRICEPS BRACHII CAPUT MEDIALE	**triceps brachii caput mediale** O: medial H I: medial 1/2 cranial olecranon		**triceps, inner humeral** O: medial H I: medial epicondyle		**triceps**		

	Ruminantia						
	Tragulidae		Antilocapridae	Giraffidae			Cervidae
	Tragulus **this work**	***Tragulus*** **Windle & Parsons, 1901**	***Antilocapra*** **Beddard, 1909**	***Giraffa*** **Owen, 1838**	***Giraffa*** **Murie, 1872c**	***Giraffa*** **Windle & Parsons, 1901**	***Mazama*** **Windle & Parsons, 1901**
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps brachii caput longum profundus** O: neck of scapula I: tip of olecranon		**triceps, scapular** O: caudal border scapula		**triceps**		
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)	**triceps brachii caput longum superficialis** O: caudal border scapula I: caudo-medial tip of olecranon		**triceps, scapular** O: caudal border scapula				
TRICEPS BRACHII ACCESSORY	- - -						
ANCONEUS	**anconeus** O: caudal H + TME I: lateral 1/2 cranial olecranon		**triceps, fourth** O: distal H I: olecranon		**triceps**		
BRACHIORADIALIS	**brachioradialis** absent	**supinator longus** absent				**supinator longus** absent	**supinator longus** absent
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis** O: lateral supracondylar crest I: base MC3	**ext carpi radiales longior & brevior** I: base cannon bone	**ext carpi radiales longior et brevior** O: lateral epicondyle			**ext carpi radiales longior & brevior** I: base cannon bone	**ext carpi radiales longior & brevior** I: base cannon bone
EXT CARPI RADIALIS, brevis (MC3)							

	Ruminantia						
	Tragulidae		Antilocapridae	Giraffidae			Cervidae
	Tragulus **this work**	***Tragulus*** **Windle & Parsons, 1901**	***Antilocapra*** **Beddard, 1909**	***Giraffa*** **Owen, 1838**	***Giraffa*** **Murie, 1872c**	***Giraffa*** **Windle & Parsons, 1901**	***Mazama*** **Windle & Parsons, 1901**
EXT DIGITORUM COMMUNIS	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle + U I: digits 3+4			**ext communis digitorum** O: lateral epicondyle I: digits 3, 4	**ext communis digitorum** O: lateral epicondyle I: digits 3, 4
EXT DIGITORUM LATERALIS	**ext digitorum lateralis** O: lateral epicondyle + U I: EDC3, digits 4, 5, 5 * two bellies	**ext minimi digiti** O: lateral epicondyle I: digits 4+5	**ext minimi digiti** O: lateral epicondyle + U I: w/ EDC * two bellies			**ext minimi digiti** O: lateral epicondyle + R I: digit 4	**ext minimi digiti** O: lateral epicondyle I: digit 4
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle I: pisiform, base MC5	**ext carpi ulnaris** O: lateral epicondyle I: pisiform w/ FCU, slip to MC4	**ext carpi ulnaris**			**ext carpi ulnaris** O: lateral epicondyle	**ext carpi ulnaris** O: lateral epicondyle I: pisiform w/ FCU, slip to MC4
SUPINATOR	**supinator** absent	**supinator brevis** absent				**supinator brevis** absent	**supinator brevis** absent
ABD POLLICIS LONGUS	**abd pollicis longus** O: U + R I: base MC2	**ext ossis metacarpi pollicis** O: U I: MC2	**ext profundus digitorum** O: lateral epicondyle I: digit 3			**ext ossis metacarpi pollicis** I: cannon bone	**ext ossis metacarpi pollicis** I: cannon bone
EXT DIGITORUM PROFUNDUS	**ext digitorum profundus** O: U I: w/ EDC						
EXT BREVIS DIGITORUM							

	Ruminantia						
	Tragulidae		**Antilocapridae**	**Giraffidae**			**Cervidae**
	Tragulus **this work**	***Tragulus*** **Windle & Parsons, 1901**	***Antilocapra*** **Beddard, 1909**	***Giraffa*** **Owen, 1838**	***Giraffa*** **Murie, 1872c**	***Giraffa*** **Windle & Parsons, 1901**	***Mazama*** **Windle & Parsons, 1901**
PRONATOR TERES	**pronator teres** O: medial epicondyle I: cranial R	**pronator teres** small	**pronator radii teres** O: U I: toward the wrist			**pronator teres**	**pronator teres** absent
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: palmar base MC3	**flx carpi radialis** O: medial epicondyle	**flx carpi radialis**			**flx carpi radialis** O: medial epicondyle	**flx carpi radialis** O: medial epicondyle
PALMARIS LONGUS	**palmaris longus** O: medial epicondyle I: digit 4f **u?**	**palmaris longus** absent				**palmaris longus** absent	**palmaris longus** absent
FLX DIGITORUM SUPERFICIALIS	**flx digitorum superficialis** O: medial epicondyle w/ PL I: digit 3f	**flx sublimis digitorum** I: digits 3, 4	**flx sublimis digitorum** O: medial epicondyle			**flx sublimis digitorum** I: digits 3, 4	**flx sublimis digitorum** I: digits 3, 4
INTERFLEXORII							

	Ruminantia						
	Tragulidae		Antilocapridae	Giraffidae			Cervidae
	Tragulus this work	*Tragulus* Windle & Parsons, 1901	*Antilocapra* Beddard, 1909	*Giraffa* Owen, 1838	*Giraffa* Murie, 1872c	*Giraffa* Windle & Parsons, 1901	*Mazama* Windle & Parsons, 1901
FLX DIGITORUM PROFUNDUS,	**flx digitorum profundus**	**flx profundus digitorum**	**flx profundus digitorum**			**flx profundus digitorum**	**flx profundus digitorum**
epicondylar			O: medial epicondyle				
epicondylar (FDPe)	O: distal medial epicondyle	O: medial epicondyle	O: medial epicondyle w/ FDS			O: medial epicondyle	O: medial epicondyle
epicondylar (FDPd)	O: distal medial epicondyle		O: medial epicondyle				
ulnar	O: medial olecranon	O: medial olecranon	O: medial olecranon			O: medial olecranon	O: medial olecranon
radial	O: medial R *I: dig 3, 4	O: R *I: digits 3, 4				O: R *I: digits 3, 4	O: R *I: digits 3, 4
LUMBRICALES	**lumbricales** O: FDP tendon I: fibers 3, 4	**lumbricales** I: digit 4	**lumbricals** absent			**lumbricales**	**lumbricales** absent
FLX CARPI ULNARIS,	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**			**flx carpi ulnaris**	**flx carpi ulnaris**
epitrochlear belly	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle			O: medial epicondyle	O: medial epicondyle
ulnar belly	- I: pisiform	O: medial olecranon	O: U				O: medial olecranon
EPITROCHLEO-ANCONEUS	**epitrochleo-anconeus** tendinous						
PRONATOR QUADRATUS	**pronator quadratus** absent	**pronator quadratus** absent				**pronator quadratus** absent	**pronator quadratus** absent

	Ruminantia						
	Tragulidae		Antilocapridae	Giraffidae			Cervidae
	Tragulus **this work**	***Tragulus*** **Windle & Parsons, 1901**	***Antilocapra*** **Beddard, 1909**	***Giraffa*** **Owen, 1838**	***Giraffa*** **Murie, 1872c**	***Giraffa*** **Windle & Parsons, 1901**	***Mazama*** **Windle & Parsons, 1901**
PALMARIS BREVIS	**palmaris brevis** absent						
FLX DIGITORUM BREVIS MANUS	**flx digitorum breves manus** absent	**flx brevis digitorum manus**				**flx brevis digitorum manus**	**flx brevis digitorum manus**
ABD DIGITI MINIMI	**abd digiti minimi** absent	**abd minimi digiti** O: pisiform					
ABD POLLICIS BREVIS	**abd pollicis brevis** absent						
CONTRAHENTES	**contrahentes** O: carpus I: digits 2+5	**oblique adductor muscles** I: digits 2, 5					
FLEXOR DIGITORUM BREVES PROFUNDUS	**flx digitorum breves profundus** 8 O: carpus	**interossei or flexores breves** 8				**interossei or flexores breves**	**interossei or flexores breves**
INTERMETACARPALES							
RADIAL SESAMOID "PRE-POLLUX"	present - in flx retinaculum						
ULNAR SESAMOID **CARPAL VIBRISSAE**	present - base MC5						

	Ruminantia continued			Whippomorpha			Tylopoda	
	Moschidae	**Bovidae**		**Hippopotamidae**			**Camelidae**	
	Moschus **Bell, 1876**	***Bos*** **Sisson, 1914**	***Capra*** **Getty, 1975**	***Choeropsis*** **Campbell, 1936**	***Choeropsis*** **Fisher et al, 2007**	***Hippopotamus*** **Windle & Parsons, 1901**	***Camelus*** **Smuts & Bezuidenhout, 1987**	***Camelus*** **Windle & Parsons, 1901**
PANNICULUS CARNOSUS			**cutaneus trunci**	**panniculus carnosus** O: sides I: fascia over triceps			**cutaneous muscle** rudimentary fascicles over triceps region	
STERNO-FACIALIS								
STERNOMASTOIDEUS		**sterno-mandibularis + sterno-mastoideus** O: fascia masseter, angle mandible, mastoid process, occiput I: manubrium + rib 1	**sternocephalicus - sternomandibularis + sternomastoideus** O: fascia of masseter, zygomatic arch ; mastoid process, mandible I: manubrium + rib 1	**sternocephalicus** O: occipital crest, fibrous from angle mandible I: manubrium		**sterno-mastoid** O: paramastoid process, ramus mandible I: sternum	**sternocephalicus** O: mastoid region I: manubrium	O: paramastoid process, angle of mandible I: ventral raphe
CLEIDOMASTOIDEUS		**brachiocephalicus; cleido-mastoideus** O: mastoid process, mandible I: clavicular intersection	**brachiocephalicus - cleidomastoideus** O: mastoid process I: clavicular intersection	**cephalohumeralis sive brachiocephalicus** O: mastoid region I: clavicular intersection	**brachiocephalicus: cliedocephalicus pars mastoidea** O: mastoid region I: clavicular intersection	**cleido-mastoid** O: paramastoid + paroccipital I: clavicular intersection	**brachiocephalicus, cleidomastoideus** O: C verts, mastoid region I: clavicular intersection	
CLAVOTRAPEZIUS		**brachiocephalicus; cleido-occipitalis** O: occiput + ligamentum nuchae I: clavicular intersection	**brachiocephalicus - cleido-occipitalis** O: occiput + ligamentum nuchae I: clavicular intersection	**cephalohumeralis sive brachiocephalicus** O: occipital crest I: clavicular intersection	**brachiocephalicus: cliedocephalicus pars occipitalis** O: occipital crest I: clavicular intersection	**cephalo-humeralis** O: occipital crest	**brachiocephalicus, cleidocervicalis** O: ligamentum nuchae I: clavicular intersection	**cephalo-humeralis** O: C verta
CEPHALOHUMERALIS				**(CT + CM / CD)**			**(CT + CM / CD)**	

	Ruminantia continued			Whippomorpha			Tylopoda	
	Moschidae	**Bovidae**		**Hippopotamidae**			**Camelidae**	
	Moschus **Bell, 1876**	***Bos*** **Sisson, 1914**	***Capra*** **Getty, 1975**	***Choeropsis*** **Campbell, 1936**	***Choeropsis*** **Fisher et al, 2007**	***Hippopotamus*** **Windle & Parsons, 1901**	***Camelus*** **Smuts & Bezuidenhout, 1987**	***Camelus*** **Windle & Parsons, 1901**
ACROMIOTRAPEZIUS		**trapezius** O: ligamentum nuchae - T12 I: spine scapula	**trapezius, cervical part** O: C2-T1 I: spine scapula	**trapezius** O: C6-T12 I: tuberosity on spine scapula	**trapezius pars cervicalis + pars thoracica** O: occipital, C1-T11 I: middle spine scapula	**trapezius** O: ligamentum nuchae	**trapezius, cervical** O: ligamentum nuchae I: spine scapula	
DORSO-CUTANEUS								
SPINOTRAPEZIUS			**trapezius, thoracic part** O: T1-12 I: spine scapula			O: T vertebrae	**trapezius, thoracic** O: T1-9 I: lateral spine scapula	
RHOMBOIDEUS CAPITIS						**r. capitis**		**r. capitis** absent
RHOMBOIDEUS CERVICIS		**r. cervicalis** O: ligamentum nuchae - T2 I: deep surface cartilage scapula	**r. cervicis** O: C2-T1 I: cranial end deep surface scapula cartilage	**rhomboideus, cervical part** O: C verts, T1 I: vertebral border scapula	**r. cervicis et thoracis** O: ligamentum nuchae, T1-T8 I: vertebral border + caudal angle scapula	**r. colli et thoracis** O: ligamentum nuchae, T1-4 I: deep surface cartilaginous portion scapula	**r. cervicis** O: fascia neck I: cranial edge scapula cartilage w/ SVC	**r. colli et thoracis** O: ligamentum nuchae, T1-2 I: deep surface cartilaginous portion scapula
RHOMBOIDEUS THORACIS		**r. thoracalis** O: T2-7+ I: deep surface cartilage scapula	**r. thoracis** O: T2-T5 I: caudal end deep surface scapula cartilage	**rhomboideus, thoracic part** O: T2-6 I: vertebral border scapula			**r. thoracis** O: T1-6 I: deep surface cartilage scapula w/ SV	
OMOTRANSVERSARIUS "metacromion"		**omo-transversarius** O: atlas I: spine scapula	**omotransversarius** O: atlas I: fascia of shoulder, w/CT	**levator scapulae ventralis** O: atlas I: acromion + fascia of scapula	**omotransversarius** O: atlas I: acromion + fascia of IN	**omo-trachelien** O: atlas I: fascia over scapula	**trapezius, cervical "ventral part"** O: C fascia I: fascia near acromion	**omo-trachelien** O: atlas
OMOTRANSVERSARIUS								

	Ruminantia continued			Whippomorpha			Tylopoda	
	Moschidae	Bovidae		Hippopotamidae			Camelidae	
	Moschus **Bell, 1876**	***Bos*** **Sisson, 1914**	***Capra*** **Getty, 1975**	***Choeropsis*** **Campbell, 1936**	***Choeropsis*** **Fisher et al, 2007**	***Hippopotamus*** **Windle & Parsons, 1901**	***Camelus*** **Smuts & Bezuidenhout, 1987**	***Camelus*** **Windle & Parsons, 1901**
OMOHYOIDEUS		**omo-hyoideus** O: neck muscles I: C3-4	**omohyoideus** O: hyoid I: C3-4			**omo-hyoid** O: hyoid I: w/ "cephalo-humeral"	**omohyoideus** O: C2+3 I: basihyoid, thyrohyoid, mylohyoideus	**omo-hyoid**
SERRATUS VENTRALIS CERVICIS		**serratus ventralis, cervical** O: C3-7, ribs 1-4 I: deep surface scapula	**serratus ventralis cervicis** O: C3-7 I: deep surface scapula	**serratus anterior** O: C1-7 I: deep surface vertebral border scapula	**serrati ventrales (serratus ventralis cervicis)** O: C1-7 I: cranial angle + deep surface scapula	**levator anguli scapulae** O: C1-7	**serratus ventralis cervicis** O: C3-7 I: cartilage + deep surface of scapula	**levator anguli scapulae**
SERRATUS VENTRALIS THORACIS		**serratus ventralis, thoracic** O: ribs 4-9 I: deep surface scapula	**serratus ventralis thoracis** O: ribs 1-8 I: caudal angle scapula	**serratus anterior** O: ribs 1-9 I: deep surface vertebral border	**serrati ventrales (serratus ventralis thoracis)** O: ribs 1-9 I: caudal angle + deep surface	**serratus magnus** O: ribs 1-8 I: deep surface scapula	**serratus ventralis thoracis** O: ribs 1-9 I: cartilage + deep surface of scapula	**serratus magnus**
CLAVODELTOIDEUS		**brachiocephalicus** O: clavicular intersection	**brachiocephalicus** O: clavicular intersection I: distal to deltoid tuberosity on H	**cephalohumeralis sive brachiocephalicus** O: clavicular intersection I: distal cranial H + medial epicondyle	**brachiocephalicus: cleidobrachialis** O: clavicular intersection I: deltoid tuberosity	**cephalo-humeralis** O: clavicular intersection I: proximal H	**brachiocephalicus, cleidobrachialis** O: clavicular intersection I: cranio-lateral H	**cephalo-humeralis** O: clavicular intersection
ACROMIODELTOIDEUS		**deltoid pars acromialis** O: acromion	**deltoideus, acromial** O: acromion I: w/ SD deltoid tuberosity	**acromiodeltoid** O: acromion + fascia S I: w/ SD on deltoid process	**deltoideus pars acromialis** O: acromion	**deltoid, acromial part** O: acromion	**deltoideus pars acromialis** O: acromion I: w/ SD deltoid tuberosity	
SPINODELTOIDEUS		**deltoid pars scapularis** O: caudal border scapula + fascia IN I: fascia of triceps	**deltoideus, scapular** O: spine + caudal border scapula I: w/ AD deltoid tuberosity	**deltoideus, scapular division** O: fascia IN + caudal border scapula I: w/ AD on deltoid process	**deltoideus pars scapularis** O: fascia IN I: w/ AD on deltoid tuberosity	**deltoid, spinous portion** O: spine scapula + fascia IN	**deltoideus pars scapularis** O: spine scapula I: w/ AD deltoid tuberosity	**deltoid, spinous portion** O: spine scapula + fascia IN

	Ruminantia continued			Whippomorpha			Tylopoda	
	Moschidae	**Bovidae**		**Hippopotamidae**			**Camelidae**	
	Moschus **Bell, 1876**	***Bos*** **Sisson, 1914**	***Capra*** **Getty, 1975**	***Choeropsis*** **Campbell, 1936**	***Choeropsis*** **Fisher et al, 2007**	***Hippopotamus*** **Windle & Parsons, 1901**	***Camelus*** **Smuts & Bezuidenhout, 1987**	***Camelus*** **Windle & Parsons, 1901**
TERES MINOR		**teres minor** "as in horse"	**teres minor** O: caudal border scapula I: caudal GT	**teres minor** O: caudal border scapula I: lateral GT	**teres minor** O: fascia IN I: lateral H dorsal to deltoid tuberosity	**teres minor** O: caudal border scapula I: GT	**teres minor** O: w/ IN I: teres minor tubercle	**teres minor** O: caudal border scapula I: GT
SUBSCAPULARIS		**subscapularis (3 parts)**	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis (subdivided)** O: subscapular fossa I: LT (sesamoid)	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT
TERES MAJOR		**teres major** "as in horse"	**teres major** O: caudal border scapula I: teres tuberosity w/ LD	**teres major** O: caudal angle I: w/ LD medial H	**teres major** O: subscapularis + caudal angle I: w/ LD on teres major tuberosity	**teres major** O: caudal border scapula I: neck H w/ LD	**teres major** O: caudal border scapula I: teres major tubercle w/ LD	
LATISSIMUS DORSI "superficial" "deep"		**latissimus dorsi** O: lumbo-dorsal fascia, ribs 11-12, I: w/ TMA	**latissimus dorsi** O: thoracolumbar fascia, T4-L, ribs 9- I: teres tuberosity w/ TMA	**latissimus dorsi** O: thoracolumbar fascia T8-13, ribs 8- I: medial H w/ TMA	**latissimus dorsi** O: thoracolumbar fascia, ribs 8-11 I: teres major tuberosity w/ TMA	**latissimus dorsi** O: t vertebrae, ribs	**latissimus dorsi** O: thoracolumbar fascia, T5-L I: teres major tubercle w/ TMA	
DORSO-EPITROCHLEARIS		**tensor fasciae antibrachii** O: caudal triceps	**tensor fasciae antibrachii** O: caudal border scapula + LD I: medial olecranon	**latissimus dorsi (dorso-epitrochlearis)** O: LD I: TME, forearm fascia			**tensor fascia antebrachii** absent	
PECTORALIS SUPERFICIALIS "clavicular"								
PECTORALIS SUPERFICIALIS "superficial"		**superficial pectoral**	**pectoralis descendens** O: sternum I: w/ CD crest of H	**pectoralis superficialis** O: manubrium + sternum I: cranial H	**pectoralis superficialis** O: sternum + abdomen I: middle cranial H	**pectoralis, superficial** O: manubrium + sternum I: pectoral ridge + H	**pectoralis superficialis, descendens** O: manubrium I: fascia cranial H	**pectoralis, superficial** O: manubrium + sternum I: pectoral ridge + H

	Ruminantia continued			Whippomorpha			Tylopoda	
	Moschidae	Bovidae		Hippopotamidae			Camelidae	
	Moschus **Bell, 1876**	***Bos*** **Sisson, 1914**	***Capra*** **Getty, 1975**	***Choeropsis*** **Campbell, 1936**	***Choeropsis*** **Fisher et al, 2007**	***Hippopotamus*** **Windle & Parsons, 1901**	***Camelus*** **Smuts & Bezuidenhout, 1987**	***Camelus*** **Windle & Parsons, 1901**
PECTORALIS SUPERFICIALIS "deep"		**superficial pectoral**	**pectoralis transversus** O: sternum I: medial H + w/ PC			**pectoralis, superficial** O: sternum I: fascia of forearm near elbow	**pectoralis superficialis, transversus** O: sternum I: fascia medial elbow	**pectoralis, superficial** O: sternum I: fascia of forearm near elbow
PECTORALIS PROFUNDUS		**deep pectoral**	**pectoralis ascendens** O: sternum + abdomen I: fascia over LT, GT, coracoid process	**pectoralis profundus** O: manubrium, sternum, abdomen I: deltoid process + GT	**pectoralis profundus** O: sternum, abdomen I: GT + LT	**pectoralis minor** O: sternum I: GHj capsule w/ PA	**pectoralis profundus** O: sternum I: coracoid + GT	**pectoralis minor** O: sternum I: GHj capsule w/ PA
PECTORALIS ABDOMINALIS						**pectoralis quartus** O: sternum + linea alba I: GT + PC		**pectoralis quartus** O: sternum + linea alba I: GT + PC
SUBCLAVIUS								
STERNOSCAPULARIS		**deep pectoral** O: sternum + rib 1 I: clavicular intersection	**subclavius** O: rib 1 I: clavicular intersection	**subclavius** O: manubrium + rib 1 I: fascia over S	**subclavius** O: manubrium + rib 1 I: clavicular intersection	**subclavius + sterno-scapularis** O: manubrium + rib 1 I: fascia over supraspinatus	**subclavius** O: rib 1 I: fascia over S	
CORACOBRACHIALIS		**coracobrachialis** "as in horse"	**coracobrachialis** O: coracoid process I: teres tuberosity	**coracobrachialis medius** O: coracoid process I: cranio-medial H	**coracobrachialis** O: coracoid process I: cranio-medial H	**coraco-brachialis**	**coracobrachialis** O: coracoid process I: cranio-medial H	**coraco-brachialis** I: proximal H
CORACOBRACHIALIS								

	Ruminantia continued			Whippomorpha			Tylopoda	
	Moschidae	**Bovidae**		**Hippopotamidae**			**Camelidae**	
	Moschus **Bell, 1876**	***Bos*** **Sisson, 1914**	***Capra*** **Getty, 1975**	***Choeropsis*** **Campbell, 1936**	***Choeropsis*** **Fisher et al, 2007**	***Hippopotamus*** **Windle & Parsons, 1901**	***Camelus*** **Smuts & Bezuidenhout, 1987**	***Camelus*** **Windle & Parsons, 1901**
BICEPS BRACHII, short head								
BICEPS BRACHII, long head		**biceps** I: R + U	**biceps brachii** O: supraglenoid tubercle I: R + U	**biceps brachii** O: lateral coracoid I: R + U	**biceps brachii** O: supraglenoid tubercle I: R + U	**biceps flexor longus cubiti** O: coracoid I: R	**biceps brachii** O: supraglenoid tubercle I: R neck	
BRACHIALIS			**brachialis** O: proximal caudal H I: R + U	**brachialis** O: caudo-medial and lateral H I: medial R + U	**brachialis** O: caudo-medial and lateral H I: R	**brachialis anticus** O: caudal neck H	**brachialis** O: lateral H I: R	**brachialis anticus** O: caudal neck H
CUBITALIS / **ARTICULARIS HUMERI**		**capsularis** absent			**articularis humeri** absent		**articularis humeri** O: neck scapula I: caudo-lateral neck H	
SUPRASPINATUS		**supraspinatus** "as in horse"	**supraspinatus** O: supraspinous fossa I: GT + LT	**supraspinatus** O: supraspinous fossa I: GT + LT	**supraspinatus** O: supraspinous fossa I: GT + LT	**supraspinatus** O: supraspinous fossa I: GT + LT		**supraspinatus** O: supraspinous fossa I: GT + LT
INFRASPINATUS		**infraspinatus** "as in horse"	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT		**infraspinatus** O: infraspinous fossa I: GT
TRICEPS BRACHII CAPUT LATERALE			**triceps brachii, lateral head** O: deltoid tuberosity H I: lateral olecranon	**triceps brachii caput laterale** O: proximal H I: lateral olecranon	**triceps brachii caput laterale** O: lateral H I: w/ TLO olecranon	**triceps, external head** O: caudal neck H	**triceps brachii caput laterale** O: lateral H I: caudo-lateral olecranon	
TRICEPS BRACHII CAPUT MEDIALE		**triceps, medial head** O: neck of H	**triceps brachii, medial head** O: neck + medial H I: medial + cranial olecranon	**triceps brachii caput mediale** O: middle H I: proximal olecranon	**triceps brachii caput mediale** O: caudo-medial H I: cranio-lateral olecranon	**triceps, inner head** O: caudal H	**triceps brachii caput mediale** O: caudo-medial H I: olecranon	

	Ruminantia continued			Whippomorpha			Tylopoda	
	Moschidae	Bovidae		Hippopotamidae			Camelidae	
	Moschus **Bell, 1876**	***Bos*** **Sisson, 1914**	***Capra*** **Getty, 1975**	***Choeropsis*** **Campbell, 1936**	***Choeropsis*** **Fisher et al, 2007**	***Hippopotamus*** **Windle & Parsons, 1901**	***Camelus*** **Smuts & Bezuidenhout, 1987**	***Camelus*** **Windle & Parsons, 1901**
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)			**triceps brachii, long head** O: caudal border scapula I: lateral + caudal olecranon	**triceps brachii caput longum, medial division** O: near glenoid on caudal border scapula		**triceps, long head** O: caudal border scapula		
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)				**triceps brachii caput longum, lateral division** O: caudal border scapula	**triceps brachii caput longum** O: caudal border scapula I: w/ TLA olecranon		**triceps brachii caput longum** O: caudal border scapula I: tip of olecranon	
TRICEPS BRACHII ACCESSORY			**triceps brachii, accessory head** O: middle caudal H I: w/ TLA					
ANCONEUS			**anconeus** O: distal caudal H I: cranial + lateral olecranon	**triceps anconeus** O: olecranon fossa + TME I: medial olecranon	**anconeus** inseparable from TME	**anconeus**	**anconeus** O: caudal H I: cranial olecranon	
BRACHIORADIALIS				**brachioradialis** absent	**brachioradialis** absent	**supinator longus** present		**supinator longus** absent
EXT CARPI RADIALIS, longus (MC2)	**ext metacarpi anterior** O: 2 heads I: base MC	**ext carpi radialis** O: lateral epicondyle I: base MC3	**ext carpi radialis** O: lateral epicondyloid crest I: MC tuberosity	**ext carpi radialis** O: lateral epicondyle I: base MC3+4	**ext carpi radialis** O: lateral epicondylar crest radial fossa I: base MC3+4	**ext carpi radiales longior & brevior** I: MC3 (slip to 2)	**ext carpi radialis** O: lateral supracondylar crest I: proximal metacarpus	**ext carpi radiales longior & brevior** I: base cannon bone
EXT CARPI RADIALIS, brevis (MC3)								

	Ruminantia continued			Whippomorpha			Tylopoda	
	Moschidae	Bovidae		Hippopotamidae			Camelidae	
	Moschus **Bell, 1876**	***Bos*** **Sisson, 1914**	***Capra*** **Getty, 1975**	***Choeropsis*** **Campbell, 1936**	***Choeropsis*** **Fisher et al, 2007**	***Hippopotamus*** **Windle & Parsons, 1901**	***Camelus*** **Smuts & Bezuidenhout, 1987**	***Camelus*** **Windle & Parsons, 1901**
EXT DIGITORUM COMMUNIS	**ext communis** I: digits 3, 4	**common digitial extensor / ext. digitialis communis** O: lateral epicondyle + U I: digits 3, 4	**ext digitorum communis - lateral superficial + medial heads** O: lateral epicondyle I: digits 3, 4	**ext digitorum communis** O: lateral epicondyle I: MCPj2, digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits (2), 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 3, 4	**ext communis digitorum** O: lateral epicondyle
EXT DIGITORUM LATERALIS	**ext digiti externi** I: digits 4, 5	**lateral digitial extensor / ext digitalis lateralis** O: lateral R + U I: digit 3	**ext digitorum lateralis** O: lateral epicondyle, R + U I: digit 4	**ext digitorum lateralis** O: lateral epicondyle + U I: digits 4+5 * two bellies incomplete	**ext digitorum lateralis** O: lateral epicondyle + U I: digits 4+5 * own retinaculum	**ext minimi digiti** O: lateral epicondyle I: digits 4+5	**ext digitorum lateralis** O: lateral epicondyle + U + R I: digit 4	**ext minimi digiti** O: lateral epicondyle I: digit 4
EXT CARPI ULNARIS			**ulnaris lateralis** O: lateral epicondyle I: pisiform + lateral MC	**ext carpi ulnaris** O: distal lateral epicondyle I: pisiform	**ext carpi ulnaris** O: caudo-lateral lateral epicondyle I: pisiform	**ext carpi ulnaris** O: lateral epicondyle I: pisiform w/ FCU, slip to MC4	**ext carpi ulnaris** O: caudal antebrachium I: pisiform, caudo-lateral metacarpus	**ext carpi ulnaris** O: lateral epicondyle
SUPINATOR					**supinator** absent	**supinator brevis** absent		**supinator brevis** absent
ABD POLLICIS LONGUS	**ext metacarpi obliquus**	**ext carpi obliquus** O: lateral R I: MC2	**abd digiti I longus** O: lateral R, U I: base MC	**abd pollicis longus** O: U I: vestige MC1	**abd digiti I longus** O: U + R I: carpal 2	**ext ossis metacarpi pollicis** O: U I: medial carpus	**abd digiti I longus** O: distolateral R I: medial metacarpus	**ext ossis metacarpi pollicis** I: cannon bone
EXT DIGITORUM PROFUNDUS	**ext digiti interni** I: digits 2, 3	**medial digital extensor / ext digiti tertii proprius** O: lateral epicondyle I: digit 3	**ext digitorum communis - lateral deep head** O: R + U I: w/ EDC		**ext digiti II** absent			
EXT BREVIS DIGITORUM								

	Ruminantia continued			Whippomorpha			Tylopoda	
	Moschidae	Bovidae		Hippopotamidae			Camelidae	
	Moschus **Bell, 1876**	***Bos*** **Sisson, 1914**	***Capra*** **Getty, 1975**	***Choeropsis*** **Campbell, 1936**	***Choeropsis*** **Fisher et al, 2007**	***Hippopotamus*** **Windle & Parsons, 1901**	***Camelus*** **Smuts & Bezuidenhout, 1987**	***Camelus*** **Windle & Parsons, 1901**
PRONATOR TERES		**pronator teres** O: medial epicondyle I: medial collateral ligament elbow	**pronator teres** O: medial epicondyle I: cranial R	**pronator teres** O: medial epicondyle I: distal R + FDPr	**pronator teres** O: medial epicondyle (2 heads) I: distal R	**pronator teres** absent		**pronator teres** rudimentary
FLX CARPI RADIALIS	**flx metacarpi internus**		**flx carpi radialis** O: medial epicondyle I: base MC	**flx carpi radialis** O: medial epicondyle I: palmar base MC2	**flx carpi radialis** O: medial epicondyle I: palmar base MC2, capitulum	**flx carpi radialis** O: medial epicondyle	**flx carpi radialis** O: medial epicondyle I: palmar base MC	**flx carpi radialis** O: medial epicondyle
PALMARIS LONGUS			**flx digitorum superficialis, superficial tendon** O: w/ FCU I: w/ FDP	**palmaris longus** O: medial epicondyle w/ FDS + FCU I: FBM	**palmaris longus** O: caudal surface medial epicondyle w/ FDS + FCU I: palmar fascia	**palmaris longus** absent		**palmaris longus** absent
FLX DIGITORUM SUPERFICIALIS	**flx perforatus** O: medial epicondyle I: digits 3, 4	**superficial digitial flexor / flx digitalis superficialis (u+m)** I: digits 3, 4	**flx digitorum superficialis, deep tendon** O: w/ FCU I: digits 3, 4	**flx digitorum sublimis (m)** O: medial epicondyle w/ FCU + PL I: digit 2f, 3, 4	**flx digitorum superficialis** O: medial epicondyle w/ FCU + PL I: digits 2f, 3f, 4f	**flx sublimis digitorum** I: digits 2, 3, 4, 5	**flx digitorum superficialis** O: pisiform I: digit 3f + 4f	**flx sublimis digitorum** I: digits 3, 4
INTERFLEXORII		between FDPe + FDS	strong fibrous band between FDS + FDP	**contribution from FDPr**	**interflexorii - absent**			

	Ruminantia continued			Whippomorpha			Tylopoda	
	Moschidae	**Bovidae**		**Hippopotamidae**			**Camelidae**	
	Moschus **Bell, 1876**	***Bos*** **Sisson, 1914**	***Capra*** **Getty, 1975**	***Choeropsis*** **Campbell, 1936**	***Choeropsis*** **Fisher et al, 2007**	***Hippopotamus*** **Windle & Parsons, 1901**	***Camelus*** **Smuts & Bezuidenhout, 1987**	***Camelus*** **Windle & Parsons, 1901**
FLX DIGITORUM PROFUNDUS,	**flx perforans**	**deep digitial flexor**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx profundus digitorum**	**flx digitorum profundus**	**flx profundus digitorum**
epicondylar						O: medial epicondyle		
epicondylar (FDPe)	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: distal medial epicondyle (m+u)	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle w/ FCU	
epicondylar (FDPd)			FDPe "may be further divided"	O: distal medial epicondyle (m+u)	O: medial epicondyle	O: medial epicondyle	O: FDPe	
ulnar	O: medial olecranon	O: medial olecranon	O: medical, caudal, lateral U	O: medial olecranon (u)	O: medial olecranon	O: medial olecranon	O: caudal U	
radial	O: R *I: digits 2, 3, 4, 5	O: R *I: digits 3, 4	O: R *I: digits 3, 4	O: medial R *I: dig 2, 3, 4, 5	*I: dig 2, 3, 4, 5	*I: dig 2, 3, 4, 5	O: medial R *I: digit 3+4	
LUMBRICALES	**lumbrical** one	**lumbricales** O: FDP I: FDS	**lumbricales** O: FDP I: FDS	**lumbricales manus** O: FDP tendon I: medial digit 4	**lumbricalis IV** O: FDP tendon I: medial digit 4	**lumbricales** I: digit 4		**lumbricales**
FLX CARPI ULNARIS,	**flx metacarpi externus**		**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**
epitrochlear belly			O: medial epicondyle	O: medial epicondyle w/ FDS + PL	O: medial epicondyle w/ FDS + PL	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle
ulnar belly			O: caudal + medial olecranon	O: olecranon	O: fascia FDPu	O: medial olecranon	O: medial olecranon	O: medial olecranon
	I: MC5		I: w/ ECU pisiform	I: pisiform	I: pisiform		I: pisiform + medial collateral ligament	
EPITROCHLEO-ANCONEUS								
PRONATOR QUADRATUS					**pronator quadratus** absent	**pronator quadratus** absent		**pronator quadratus** absent

	Ruminantia continued			Whippomorpha			Tylopoda	
	Moschidae	Bovidae		Hippopotamidae			Camelidae	
	Moschus Bell, 1876	*Bos* Sisson, 1914	*Capra* Getty, 1975	*Choeropsis* Campbell, 1936	*Choeropsis* Fisher et al, 2007	*Hippopotamus* Windle & Parsons, 1901	*Camelus* Smuts & Bezuidenhout, 1987	*Camelus* Windle & Parsons, 1901
PALMARIS BREVIS								
FLX DIGITORUM BREVIS MANUS				**flx brevis manus** O: PL I: 4f+5f	**palmaris longus + flx digitorum brevis** O: PL I: 4+5f	**flx brevis digitorum manus**		**flx brevis digitorum manus**
ABD DIGITI MINIMI	**short flexor of 5th digit** absent			**abd digiti quinti manus** O: pisiform I: 5f	**abd digiti V** O: pisiform I: 5f	**abd minimi digiti** O: pisiform		
ABD POLLICIS BREVIS								
CONTRAHENTES				**contrahentes digitorum manus** O: capitate + hamate I: digits 2+5	**add digiti II, add digiti V** O: carpals I: digits 2+5			
FLEXOR DIGITORUM BREVES PROFUNDUS	**interossei** 4	**interosseus medius** 4	**interosseus** 1->5	**flx breves profundi manus** 8 O: carpus + MC	**interossei** 8 O: carpus + MC	**interossei or flexores breves**	**interosseus medius** 2	**interossei or flexores breves**
INTERMETACARPALES								
RADIAL SESAMOID "PRE-POLLUX"								
ULNAR SESAMOID **CARPAL VIBRISSAE**								

	Mysticeti				
	Balaenidae		**Balaenopteridae**		**Eschrichtiidae**
	Balaena **Cooper et al, 2007**	***Eubalaena*** **Cooper et al, 2007**	***Balaenoptera*** **Carte & Macalister, 1868**	***Balaenoptera*** **Cooper et al, 2007**	***Eschrichtius*** **Cooper et al, 2007**
PANNICULUS CARNOSUS					
STERNO-FACIALIS					
STERNOMASTOIDEUS			**sternomastoid** O: mastoid process I: sternum, rib 1		
CLEIDOMASTOIDEUS					
CLAVOTRAPEZIUS			**mastohumeral** O: paramastoid process, C vertebrae I: cranial H		
CEPHALOHUMERALIS					
ACROMIOTRAPEZIUS					
DORSO-CUTANEUS					
SPINOTRAPEZIUS					
RHOMBOIDEUS CAPITIS					
RHOMBOIDEUS CERVICIS					
RHOMBOIDEUS THORACIS					
OMOTRANSVERSARIUS "metacromion"					
OMOTRANSVERSARIUS					

	Mysticeti				
	Balaenidae		Balaenopteridae		Eschrichtiidae
	Balaena **Cooper et al, 2007**	*Eubalaena* **Cooper et al, 2007**	*Balaenoptera* **Carte & Macalister, 1868**	*Balaenoptera* **Cooper et al, 2007**	*Eschrichtius* **Cooper et al, 2007**
OMOHYOIDEUS			**omohyoid** O: hyoid I: coracoid process + cranial border scapula		
SERRATUS VENTRALIS CERVICIS			**levator anguli scapulae** O: C7 I: cranial angle scapula		
SERRATUS VENTRALIS THORACIS			**serratus magnus vel depressor anguli scapulae** O: abdomen, ribs 3-11 I: caudal border scapula w/ TMA		
CLAVODELTOIDEUS					
ACROMIODELTOIDEUS					
SPINODELTOIDEUS			**deltoid** O: fascia IN I: cranio-medial H		
TERES MINOR					
SUBSCAPULARIS			**subscapularis** O: subscapular fossa I: cranial head H		
TERES MAJOR			**teres major** O: caudal border scapula I: cranio-medial neck H		

	Mysticeti				
	Balaenidae		Balaenopteridae		Eschrichtiidae
	Balaena **Cooper et al, 2007**	***Eubalaena*** **Cooper et al, 2007**	***Balaenoptera*** **Carte & Macalister, 1868**	***Balaenoptera*** **Cooper et al, 2007**	***Eschrichtius*** **Cooper et al, 2007**
LATISSIMUS DORSI "superficial" "deep"			**latissimus dorsi** O: T1-L vertebrae I: caudal angle scapula		
DORSO-EPITROCHLEARIS					
PECTORALIS SUPERFICIALIS "clavicular"					
PECTORALIS SUPERFICIALIS "superficial"			**pectoralis major** O: sternum, ribs, abdomen I: cranial head H, integument + fascia axilla		
PECTORALIS SUPERFICIALIS "deep"					
PECTORALIS PROFUNDUS			**lessor pectoral** absent		
PECTORALIS ABDOMINALIS					
SUBCLAVIUS					
STERNOSCAPULARIS					
CORACOBRACHIALIS			**coracobrachialis** O: coracoid process I: cranio-medial H		
CORACOBRACHIALIS					
BICEPS BRACHII, short head	**biceps brachii** absent	**biceps brachii** absent	**biceps flexor cubiti** "few tendinous bands, rudiments"	**biceps brachii** absent	**biceps brachii** absent
BICEPS BRACHII, long head					
BRACHIALIS	**brachialis** absent	**brachialis** absent		**brachialis** absent	**brachialis** absent
CUBITALIS/ ARTICULARIS HUMERI					

	Mysticeti				
	Balaenidae		**Balaenopteridae**		**Eschrichtiidae**
	Balaena **Cooper et al, 2007**	***Eubalaena*** **Cooper et al, 2007**	***Balaenoptera*** **Carte & Macalister, 1868**	***Balaenoptera*** **Cooper et al, 2007**	***Eschrichtius*** **Cooper et al, 2007**
SUPRASPINATUS			**supraspinatus** O: supraspinous fossa + acromion process I: cranio-lateral head H		
INFRASPINATUS			**infraspinatus** O: infraspinous fossa I: lateral head H		
TRICEPS BRACHII CAPUT LATERALE	**triceps brachii caput laterale** O: caudal H I: olecranon		**triceps, external head** O: proximal caudal H I: olecranon	**triceps brachii caput laterale** O: caudal H I: olecranon	**triceps brachii caput laterale** O: caudal H I: olecranon
TRICEPS BRACHII CAPUT MEDIALE			**triceps, internal** O: caudal H I: olecranon		
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)			**triceps, long head** O: caudal neck scapula I: olecranon	**triceps brachii caput longum** O: caudal border scapula I: olecranon	**triceps brachii caput longum** O: caudal border scapula I: olecranon
TRICEPS BRACHII CAPUT LONGUM					
TRICEPS BRACHII ACCESSORY					
ANCONEUS					
BRACHIORADIALIS					
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis** absent	**ext carpi radialis** absent		**ext carpi radialis** absent	**ext carpi radialis** absent
EXT CARPI RADIALIS, brevis (MC3)					

	Mysticeti				
	Balaenidae		**Balaenopteridae**		**Eschrichtiidae**
	Balaena **Cooper et al, 2007**	***Eubalaena*** **Cooper et al, 2007**	***Balaenoptera*** **Carte & Macalister, 1868**	***Balaenoptera*** **Cooper et al, 2007**	***Eschrichtius*** **Cooper et al, 2007**
EXT DIGITORUM COMMUNIS	**ext digitorum communis** O: interosseus space I: ?	**ext digitorum communis** O: interosseus space + U I: digits 2, 3, 4, 5	**ext digitorum communis** O: interosseus space I: digits 2, 3, 4, 5	**ext digitorum communis** O: interosseus space + R I: carpus, digits 2, 3, 4, 5	**ext digitorum communis** O: interosseus space + U I: digits 2, 3, 4, 5
EXT DIGITORUM LATERALIS					
EXT CARPI ULNARIS					
SUPINATOR					
ABD POLLICIS LONGUS					
EXT DIGITORUM PROFUNDUS					
EXT BREVIS DIGITORUM					
PRONATOR TERES					
FLX CARPI RADIALIS	**flx carpi radialis** absent	**flx carpi radialis** O: R I: carpus	**flx carpi radialis** O: cranial R I: base MC2	**flx carpi radialis** absent	**flx carpi radialis** O: R + distal H I: scaphoid
PALMARIS LONGUS					
FLX DIGITORUM SUPERFICIALIS	**flx digitorum radialis** O: R I: digit 2	**flx digitorum radialis** absent	**palmaris longus** O: olecranon I: MC4 + palmar fascia	**flx digitorum radialis** O: R I: digit 2	**flx digitorum radialis** absent
INTERFLEXORII					

	Mysticeti				
	Balaenidae		**Balaenopteridae**		**Eschrichtiidae**
	Balaena **Cooper et al, 2007**	***Eubalaena*** **Cooper et al, 2007**	***Balaenoptera*** **Carte & Macalister, 1868**	***Balaenoptera*** **Cooper et al, 2007**	***Eschrichtius*** **Cooper et al, 2007**
FLX DIGITORUM PROFUNDUS, **epicondylar** **epicondylar (FDPe)** **epicondylar (FDPd)** **ulnar** **radial**	**flx digitorum communis** O: U *I: digits 2, 3, 4, 5	**flx digitorum communis** O: U *I: digits 2, 3, 4, 5	**flx digitorum communis** O: few fibers medial H O: medial olecranon *I: digits 2, 3, 4, 5	**flx digitorum communis** O: H O: U *I: digits 2, 3, 4, 5	**flx digitorum communis** O: U *I: digits 2, 3, 4, 5
LUMBRICALES	**lumbricales** absent	**lumbricales** absent		**lumbricales** absent	**lumbricales** absent
FLX CARPI ULNARIS, **epitrochlear belly** **ulnar belly**	**flx carpi ulnaris** O: olecranon I: pisiform	**flx carpi ulnaris** O: olecranon I: pisiform	**flx carpi ulnaris** O: medial olecranon I: MC4	**flx carpi ulnaris** O: olecranon I: pisiform	**flx carpi ulnaris** O: olecranon I: pisiform
EPITROCHLEO-ANCONEUS					
PRONATOR QUADRATUS **PALMARIS BREVIS**					
FLX DIGITORUM BREVIS MANUS					
ABD DIGITI MINIMI	**abd digit V** absent	**abd digit V** absent		**abd digit V** absent	**abd digit V** absent
ABD POLLICIS BREVIS					
CONTRAHENTES	**contrahentes** absent	**contrahentes** absent		**contrahentes** absent	**contrahentes** absent
FLEXOR DIGITORUM BREVES PROFUNDUS					
INTERMETACARPALES					
RADIAL SESAMOID "PRE-POLLUX"					
ULNAR SESAMOID					
CARPAL VIBRISSAE					

	Odontoceti							
	Delphinidae				**Monodontidae**	**Phocoenidae**		**Physeteridae**
	Delpihinus **Cooper et al, 2007**	***Globicephala*** **Murie, 1873b**	***Orcinus*** **Cooper et al, 2007**	***Tursiops*** **Cooper et al, 2007**	***Monodon*** **Howell, 1930**	***Neophocaena*** **Howell, 1927**	***Phocoena*** **Cooper et al, 2007**	***Physeter*** **Cooper et al, 2007**
PANNICULUS CARNOSUS		**panniculus carnosus** O: whole body I: axillary poriton w/ LD, w/ PS			**panniculus carnosus** I: axillary region	**panniculus carnosus** I: raphe near axilla		
STERNO-FACIALIS								
STERNOMASTOIDEUS		**sterno-mastoid** O: paramastoid w/ CT			**sternomastoideus** O: exoccipital I: manubrium	**sternomastoideus** O: exoccipital I: manubrium		
CLEIDOMASTOIDEUS					**mastoscapularis** O: exoccipital I: deltoid near acromion			
CLAVOTRAPEZIUS		**cephalo-humeral** O: paramastoid w/ SM I: head H			**mastohumeralis** O: exoccipital I: LT	**mastohumeralis** O: exoccipital I: LT		
CEPHALOHUMERALIS								
ACROMIOTRAPEZIUS					**trapezius group** absent	**trapezius**		
DORSO-CUTANEUS								
SPINOTRAPEZIUS								
RHOMBOIDEUS CAPITIS						**occipitoscapularis** absent		
RHOMBOIDEUS CERVICIS								
RHOMBOIDEUS THORACIS		**rhomboideus** "single"			**rhomboideus** O: mid-dorsum I: cartilaginous portion scapula	**rhomboideus** O: mid-dorsum I: cartilaginous portion scapula		
OMOTRANSVERSARIUS "metacromion"		**homologue of a levator claviculae** O: atlas I: S + IN			**atlantoscapularis** O: atlas I: surface deltoid	**levator anguli scapulae** O: atlas I: cartilaginous portion scapula		
OMOTRANSVERSARIUS								

	Odontoceti							
	Delphinidae				Monodontidae	Phocoenidae		Physeteridae
	Delpihinus **Cooper et al, 2007**	***Globicephala*** **Murie, 1873b**	***Orcinus*** **Cooper et al, 2007**	***Tursiops*** **Cooper et al, 2007**	***Monodon*** **Howell, 1930**	***Neophocaena*** **Howell, 1927**	***Phocoena*** **Cooper et al, 2007**	***Physeter*** **Cooper et al, 2007**
OMOHYOIDEUS		**omo-hyoid** absent				**omohyoid** absent		
SERRATUS VENTRALIS CERVICIS		**levator anguli scapulae** O: atlas, C vertebrae I: cranial angle scapula						
SERRATUS VENTRALIS THORACIS		**serratus magnus** O: ? Vertebrae, ribs 2-3 I: scapula			**serratus magnus** O: ribs 2-6 I: vertebral border scapula	**serratus magnus** O: ribs 3-7 I: cartilaginous portion scapula		
CLAVODELTOIDEUS								
ACROMIODELTOIDEUS					**deltoideus, superficial part** O: vertebral border scapula + acromion I: H	**deltoideus** O: cartilaginous portion scapula I: middle lateral H		
SPINODELTOIDEUS		**deltoid, scapular**			**deltoideus, deeper part** O: scapula I: H			
TERES MINOR								
SUBSCAPULARIS		**subscapularis** O: subscapular fossa I: head H			**subscapularis** O: deep surface scapula I: LT	**subscapularis** O: deep surface scapula I: LT		
TERES MAJOR		**teres major and teres minor** "single"			**teres major** O: scapula w/ SS I: medial ridge H	**teres major** O: caudal border scapula I: distal medial H		

	Odontoceti							
	Delphinidae				**Monodontidae**	**Phocoenidae**		**Physeteridae**
	Delpihinus **Cooper et al, 2007**	***Globicephala*** **Murie, 1873b**	***Orcinus*** **Cooper et al, 2007**	***Tursiops*** **Cooper et al, 2007**	***Monodon*** **Howell, 1930**	***Neophocaena*** **Howell, 1927**	***Phocoena*** **Cooper et al, 2007**	***Physeter*** **Cooper et al, 2007**
LATISSIMUS DORSI "superficial" "deep"		**latissimus dorsi** O: ribs 5-7 I: medial neck H			**latissimus dorsi** O: 2 parts I: middle H			
DORSO-EPITROCHLEARIS								
PECTORALIS SUPERFICIALIS "clavicular"								
PECTORALIS SUPERFICIALIS "superficial"		**pectoralis major** O:sternum, ribs 1-4 I: distal H, w/ PC			**pectoralis superficialis** O: sternum I: medial H	**pectoralis** O: sternum I: distal caudo-medial H		
PECTORALIS SUPERFICIALIS "deep"								
PECTORALIS PROFUNDUS		**pectoralis minor** O: rib 4 I: fascia medial flipper			**pectoralis profundus** O: ribs 1-2, sternum I: coracoid			
PECTORALIS ABDOMINALIS								
SUBCLAVIUS								
STERNOSCAPULARIS								
CORACOBRACHIALIS		**coraco-brachialis** O: coracoid I: medial process H			**coracobrachialis** O: coracoid I: medial LT			
CORACOBRACHIALIS								
BICEPS BRACHII, short head	**biceps brachii** absent		**biceps brachii** absent	**biceps brachii** absent	**biceps relic** O: medial head H I: tissue above elbow		**biceps brachii** absent	**biceps brachii** absent
BICEPS BRACHII, long head								
BRACHIALIS	**brachialis** absent		**brachialis** absent	**brachialis** absent			**brachialis** absent	**brachialis** absent
CUBITALIS/ ARTICULARIS HUMERI								

	Odontoceti							
	Delphinidae				**Monodontidae**	**Phocoenidae**		**Physeteridae**
	Delpihinus **Cooper et al, 2007**	***Globicephala*** **Murie, 1873b**	***Orcinus*** **Cooper et al, 2007**	***Tursiops*** **Cooper et al, 2007**	***Monodon*** **Howell, 1930**	***Neophocaena*** **Howell, 1927**	***Phocoena*** **Cooper et al, 2007**	***Physeter*** **Cooper et al, 2007**
SUPRASPINATUS		**supraspinatus**			**supraspinatus** O: cranial angle scapula + acromion I: head H	**supraspinatus** O: cranial angle scapula + acromion I: head H		
INFRASPINATUS		**infraspinatus**			**infraspinatus** O: caudal scapula I: lateral head H	**infraspinatus** O: cartilaginous portion scapula I: cranio-lateral fossa H		
TRICEPS BRACHII CAPUT LATERALE	**triceps brachii caput laterale**	**triceps, tendinous** O: head H	**triceps brachii caput laterale**	**triceps brachii caput laterale**	**triceps** O: distal H I: U	**triceps, humeral head** O: LT I: olecranon	**triceps brachii caput laterale**	**triceps brachii caput laterale** O: distal caudal H I: olecranon
TRICEPS BRACHII CAPUT MEDIALE								
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)		**triceps, narrow slip** O: neck scapula						**triceps brachii caput longum** O: caudal border scapula I: olecranon
TRICEPS BRACHII CAPUT LONGUM								
TRICEPS BRACHII ACCESSORY								
ANCONEUS								**?** O: caudal H I: olecranon + FCU
BRACHIORADIALIS								
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis** absent		**ext carpi radialis** absent	**ext carpi radialis** absent			**ext carpi radialis** absent	**ext carpi radialis** absent
EXT CARPI RADIALIS, brevis (MC3)								

	Odontoceti							
	Delphinidae				Monodontidae	Phocoenidae		Physeteridae
	Delpihinus **Cooper et al, 2007**	***Globicephala*** **Murie, 1873b**	***Orcinus*** **Cooper et al, 2007**	***Tursiops*** **Cooper et al, 2007**	***Monodon*** **Howell, 1930**	***Neophocaena*** **Howell, 1927**	***Phocoena*** **Cooper et al, 2007**	***Physeter*** **Cooper et al, 2007**
EXT DIGITORUM COMMUNIS	**ext digitorum communis** absent		**ext digitorum communis** O: interosseus space I: disappears	**ext digitorum communis** absent	**ext digitorum** O: distal H I: "diverging unevenly"		**ext digitorum communis** absent	**ext digitorum communis** O: interosseus space + H + R + U I: digits 2, 3, 4, 5
EXT DIGITORUM LATERALIS								
EXT CARPI ULNARIS								
SUPINATOR								
ABD POLLICIS LONGUS								
EXT DIGITORUM PROFUNDUS								
EXT BREVIS DIGITORUM								
PRONATOR TERES								
FLX CARPI RADIALIS	**flx carpi radialis** absent		**flx carpi radialis** absent	**flx carpi radialis** absent			**flx carpi radialis** absent	**flx carpi radialis** absent
PALMARIS LONGUS								**small unnamed muscle** O: caudomedial U I: fascia carpus
FLX DIGITORUM SUPERFICIALIS	**flx digitorum radialis** absent		**flx digitorum radialis** absent	**flx digitorum radialis** absent			**flx digitorum radialis** absent	**flx digitorum radialis** O: H + R I: digit 2
INTERFLEXORII								

	Odontoceti							
	Delphinidae				**Monodontidae**	**Phocoenidae**		**Physeteridae**
	Delpihinus **Cooper et al, 2007**	***Globicephala*** **Murie, 1873b**	***Orcinus*** **Cooper et al, 2007**	***Tursiops*** **Cooper et al, 2007**	***Monodon*** **Howell, 1930**	***Neophocaena*** **Howell, 1927**	***Phocoena*** **Cooper et al, 2007**	***Physeter*** **Cooper et al, 2007**
FLX DIGITORUM PROFUNDUS,	**flx digitorum communis**		**flx digitorum communis**	**flx digitorum communis**	**flx digitorum**		**flx digitorum communis**	**flx digitorum communis**
epicondylar	absent		absent	absent	"few disassociated fibers"		absent	
epicondylar (FDPe)								O: H
epicondylar (FDPd)								
ulnar								O: U
radial								O: R *I: digits 2, 3, 4, 5
LUMBRICALES	**lumbricales** absent		**lumbricales** absent	**lumbricales** absent			**lumbricales** absent	**lumbricales** absent
FLX CARPI ULNARIS,	**flx carpi ulnaris**		**flx carpi ulnaris**	**flx carpi ulnaris**			**flx carpi ulnaris**	**flx carpi ulnaris**
epitrochlear belly								
ulnar belly	O: olecranon I: pisiform		O: olecranon I: pisiform	O: olecranon I: pisiform			O: olecranon I: pisiform	O: olecranon I: pisiform
EPITROCHLEO-ANCONEUS								
PRONATOR QUADRATUS PALMARIS BREVIS								
FLX DIGITORUM BREVIS MANUS								
ABD DIGITI MINIMI	**abd digit V** absent		**abd digit V** absent	**abd digit V** absent			**abd digit V** absent	**abd digit V** O: MC5 I: digit 5
ABD POLLICIS BREVIS								
CONTRAHENTES	**contrahentes** absent		**contrahentes** absent	**contrahentes** absent			**contrahentes** absent	**contrahentes** absent
FLEXOR DIGITORUM BREVES PROFUNDUS								**interosseus**
INTERMETACARPALES								
RADIAL SESAMOID "PRE-POLLU								
ULNAR SESAMOID								
CARPAL VIBRISSAE								

	Anomaluromorpha	**Castorimorpha**			**Sciuromorpha**	
	Pedetidae	**Castoridae**	**Heteromyidae**		**Sciuridae**	
	Pedetes **Parsons, 1898b**	***Castor*** **Young, 1937**	***Dipodomys*** **Howell, 1932**	***Heteromys*** **Ryan, 1989**	***Marmota*** **Bezuidenhout & Evans, 2005**	***Spermophilus*** **Thorington et al, 1997**
PANNICULUS CARNOSUS	**panniculus carnosus**	**cutaneus omobrachialis** O: T vertebrae I: spine scapula, GT w/ PA, H w/ pectorals	**panniculus carnosus** O: dorsal midline I: proximal pectoral crest w/ PS	**cutaneus maximus** O: dorsum I: lateral crest H w/ PA	**cutaneus trunci** O: thorax + abdomen I: w/ LD	**cutaneus maximus** O: thorax + abdomen I: GHj + w/ PA + LD
STERNO-FACIALIS						
STERNOMASTOIDEUS	**sterno-mastoid** O: paroccipital I: manubrium	**sterno-occipitalis** O: occiput I: manubrium	**sternomastoideus** O: auditory bulla I: manubrium	**sternomastoideus** O: EAM w/ CM I: manubrium	**sternomastoideus** O: mastoid I: manubrium	**sternomastoideus** O: mastoid I: manubrium
CLEIDOMASTOIDEUS	**cleido-mastoid** O: paroccipital + occipital crest I: medial clavicle	**cleido-occipitalis** O: nuchal crest I: medial clavicle	**cleidomastoideus** I: clavicle	**cleidomastoideus** O: EAM w/ SM I: medial clavicle	**cleidomastoideus** O: mastoid I: medial clavicle	**cleidomastoideus** O: mastoid I: clavicle
CLAVOTRAPEZIUS				**cleido-occipitalis** O: lambdoidal crest I: middle clavicle	**cleido-occipitalis** O: nuchal crest I: clavicle	**cleido-occipitalis** O: nuchal crest I: clavicle
CEPHALOHUMERALIS						
ACROMIOTRAPEZIUS	**trapezius**	**trapezius** O: nuchal crest, ligamentum nuchae, T vertebrae I: lateral clavicle, acromion + spine scapula	**acromiotrapezius** O: occiput I: acromion + spine scapula	**acromiotrapezius** O: ligamentum nuchae I: clavicle, acromion, spine scapula	**trapezius pars cervicalis** O: occiput, C vertebrae I: acromion + spine scapula	**trapezius** O: nuchal crest, ligamentum nuchae, T1-10 I: metacromion + spine scapula
AURICULAR SLIP				**retractor sacculi pars trapezius** O: L vertebrae I: face w/ platysma		

	Anomaluromorpha	**Castorimorpha**			**Sciuromorpha**	
	Pedetidae	**Castoridae**	**Heteromyidae**		**Sciuridae**	
	Pedetes **Parsons, 1898b**	***Castor*** **Young, 1937**	***Dipodomys*** **Howell, 1932**	***Heteromys*** **Ryan, 1989**	***Marmota*** **Bezuidenhout & Evans, 2005**	***Spermophilus*** **Thorington et al, 1997**
SPINOTRAPEZIUS			**spinotrapezius** I: spine scapula	**spinotrapezius** O: L1-3 I: spine scapula	**trapezius pars thoracica** O: T1-6 I: spine scapula	
RHOMBOIDEUS CAPITIS	**rhomboideus capitis, colli et thoracis** "continuous"	**levator scapulae** O: nuchal crest + paramastoid I: vertebral border + spine scapula	**rhomboideus pars capitis** O: mastoid region I: vertebral border scapula	**occipitoscapularis** O: lambdoidal crest I: near cranial angle scapula	**rhomboideus capitis** O: nuchal crest, mastoid I: vertebral border scapula w/ RC	**occipitoscapularis** O: nuchal crest I: spine scapula + vertebral border scapula
RHOMBOIDEUS CERVICIS		**rhomboideus** O: nuchal crest, ligamentum nuchae I: vertebral border scapula	**rhomboideus pars dorsi** O: occiput I: vertebral border scapula	**rhomboideus** O: sagittal crest + ligamentum nuchae I: vertebral border scapula	**rhomboideus cervicis** O: C1-7 I: vertebral border scapula w/ RO	**rhomboideus** O: C vertebrae, proximal T vertebrae I: vertebral border scapula
RHOMBOIDEUS THORACIS					**rhomboideus thoracis** O: T1 I: vertebral border scapula	
OMOTRANSVERSARIUS "metacromion"	**omo-trachelian** O: atlas I: metacromion	**omo transversarius** O: atlas I: acromion	**atlantoscapularis inferior** O: atlas I: AT + lateral clavicle	**omocervicalis** O: atlas I: lateral clavicle + acromion	**omotransversarius, ventral part** O: atlas I: acromion	**atlantoscapularis ventralis (omocervicalis)** O: atlas I: metacromion
OMOTRANSVERSARIUS			**atlantoscapularis superior** O: atlas I: w/ SVT		**omotransversarius, dorsal part** O: atlas I: acromion	**atlantoscapularis dorsalis** O: atlas I: spine scapula w/ RO
OMOHYOIDEUS	**omo-hyoid** absent	**omohyoideus** O: hyoid I: cranial border neck scapula	**omohyoideus** O: hyoid I: scapula	**omohyoideus** O: hyoid I: cranial edge scapula near coracoid	**omohyoideus** O: basihyoid I: cranial border neck scapula	**omohyoid** O: hyoid I: cranial border scapula

	Anomaluromorpha	Castorimorpha			Sciuromorpha	
	Pedetidae	**Castoridae**	**Heteromyidae**		**Sciuridae**	
	Pedetes **Parsons, 1898b**	***Castor*** **Young, 1937**	***Dipodomys*** **Howell, 1932**	***Heteromys*** **Ryan, 1989**	***Marmota*** **Bezuidenhout & Evans, 2005**	***Spermophilus*** **Thorington et al, 1997**
SERRATUS VENTRALIS CERVICIS		**serratus cervicis** O: C4-7, rib 1 I: deep surface scapula w/ SVT	**depressor scapulae** O: C2-7 I: w/ SVT			
SERRATUS VENTRALIS THORACIS	**levator anguli scapulae and serratus magnus** O: C1-7, rib 1, ribs 3-7 I: vertebral border scapula	**serratus thoracis** O: ribs 3-8 I: deep surface scapula w/ SVC	**serratus magnus** O: ribs 2-7 I: vertebral border scapula	**levator scapulae et serratus anterior** O: C vertebrae, ribs 1-8 I: deep surface vertebral border scapula	**serratus ventralis** O: C5-7, ribs 1-9 I: deep surface scapula	**levator scapulae et serratus ventralis** O: C vertebrae + ribs I: vertebral border scapula
CLAVODELTOIDEUS	**deltoid** O: "as usual" I: H				**deltoideus pars clavicularis + cleidobrachialis** O: lateral clavicle (2 heads) I: deltoid tubercle H // w/ B to U	**clavodeltoid + clavobrachialis** O: lateral clavicle (2 heads) I: medial deltoid ridge H // U
ACROMIODELTOIDEUS	**deltoid** O: "as usual" I: H	**deltoideus, acromial part** O: acromion + clavicle I: deltoid tuberosity H w/ SD	**deltoideus** O: clavicle, acromion, spine scapula I: deltoid crest H	**clavo-acromiodeltoideus** O: lateral clavicle + acromion I: lateral deltoid crest H	**deltoideus pars acromialis** O: acromion I: deltoid tubercle H	**acromiodeltoid** O: acromion I: lateral deltoid ridge H w/ SD
SPINODELTOIDEUS	**deltoid** O: "as usual" I: H	**deltoideus, scapular part** O: spine scapula I: deltoid tuberosity H w/ AD		**spinodeltoideus** O: spine scapula I: lateral deltoid crest H	**deltoideus pars scapularis** O: spine scapula + fascia IN I: deltoid tubercle H	**spinodeltoid** O: spine scapula I: lateral deltoid ridge H w/ AD
TERES MINOR			**teres minor** O: caudal border scapula I: GT	**teres minor** O: caudal border scapula I: GT	**teres minor** O: caudal border scapula I: tricipital line H	**teres minor** O: caudal border scapula I: distal GT
SUBSCAPULARIS		**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT

	Anomaluromorpha	Castorimorpha			Sciuromorpha	
	Pedetidae	**Castoridae**	**Heteromyidae**		**Sciuridae**	
	Pedetes **Parsons, 1898b**	***Castor*** **Young, 1937**	***Dipodomys*** **Howell, 1932**	***Heteromys*** **Ryan, 1989**	***Marmota*** **Bezuidenhout & Evans, 2005**	***Spermophilus*** **Thorington et al, 1997**
TERES MAJOR	**teres major**	**teres major** O: caudal border scapula I: teres major tubercle medial H	**teres major** O: caudal angle scapula I: proximal medial crest H	**teres major** O: caudal angle scapula I: medial H w/ LD	**teres major** O: caudal angle scapula I: teres major tubercle H	**teres major** O: caudal border scapula I: medial H w/ LD
LATISSIMUS DORSI "superficial" "deep"	**latissimus dorsi** O: ribs 9-12, lumbar fascia I: H	**latissimus dorsi** O: T vertebrae, ribs 7-12 I: cranio-medial H	**latissimus dorsi** O: dorsal fadscia I: TMA tendon	**latissimus dorsi** O: L1-6 I: medial H w/ TMA	**latissimus dorsi** O: T1-13, ribs 9-12 I: GT w/ PS	**latissimus dorsi** O: caudal 6T-L2, caudal 4 ribs I: medial H w/ TMA
DORSO-EPITROCHLEARIS			**dorso-epitrochlearis** O: TMA + LD I: medial olecranon	**dorsoepitrochlearis** O: TMA I: medial olecranon	**tensor fasciae antebrachii** O: TMA + LD I: TLO + medial forearm fascia	**dorsoepitrochlearis** O: TMA + LD I: medial U
PECTORALIS SUPERFICIALIS "clavicular"						
PECTORALIS SUPERFICIALIS "superficial"		**pectoralis sublimis** O: clavicle, sternum, ribs 1-7 I: proximal medial H	**pectoral, superficial a** O: manubrium + sternum I: proximal deltoid process H w/ PSd	**pectoralis major** O: manubrium + sternum I: proximal H	**pectoralis superficialis, pars descendens and transversus** O: manubrium + sternum I: crest H	**pectoralis major** O: manubrium + sternum I: deltoid ridge H
PECTORALIS SUPERFICIALIS "deep"			**pectoral, superficial a'** O: deep to PSs I: proximal deltoid process H w/ PSs			
PECTORALIS PROFUNDUS	**pectoralis minor** I: proximal pectoral ridge H	**pectoralis profundus, cephalus** O: sternum, ribs 3-6 I: GT	**pectoral, deep b** O: deep to PSs I: head H w/ PA	**pectoralis minor** O: sternum I: coracoid + medial head H	**pectoralis profundus** O: sternum I: GT + crest H	**pectoralis minor** O: sternum I: deltoid ridge H

	Anomaluromorpha	**Castorimorpha**			**Sciuromorpha**	
	Pedetidae	**Castoridae**	**Heteromyidae**		**Sciuridae**	
	Pedetes **Parsons, 1898b**	***Castor*** **Young, 1937**	***Dipodomys*** **Howell, 1932**	***Heteromys*** **Ryan, 1989**	***Marmota*** **Bezuidenhout & Evans, 2005**	***Spermophilus*** **Thorington et al, 1997**
PECTORALIS ABDOMINALIS	**abdomino-humeralis** present	**pectoralis profundus, caudalus** O: linea alba I: GT w/ PC	**pectoral, deep b'** O: external oblique + rectus abdominis I: head H w/ PP	**pectoralis abdominalis** O: sternum + xiphisternum I: proximal lateral crest H w/ PC	**pectoralis profundus** O: xiphoid + linea alba I: GT + crest H	**pectoralis abdominalis** O: abdominal fascia I: proximal medial deltoid rige H
SUBCLAVIUS	**subclavius** O: rib 1 I: clavicle	**subclavius** O: rib 1 I: clavicle	**subclavius** O: rib 1 I: clavicle	**subclavius** O: rib 1 I: middle clavicle	**subclavius** O: rib 1 I: clavicle	**subclavius** O: rib 1 I: clavicle
STERNOSCAPULARIS	**scapulo-clavicularis** absent		**scapuloclavicularis** absent	**scapuloclavicularis** O: lateral clavicle I: vertebral border + spine scapula		
CORACOBRACHIALIS	**coraco-brachialis** O: coracoid I: middle medial H + medial epicondyle	**coracobrachialis** O: coracoid I: medial H near medial epicondyle	**coracobrachialis pars media** O: coracoid I: H	**coracobrachialis** O: coracoid I: medial H	**coracobrachialis** O: coracoid I: distal caudo-medial H	**coracobrachialis, short head** O: coracoid I: medial H distal to GT
CORACOBRACHIALIS		**coracobrachialis** O: coracoid I: proximal medial H	**coracobrachialis pars profunda** O: coracoid I: neck H			**coracobrachialis, long head** O: coracoid I: distal medial H + medial epicondylar ridge
BICEPS BRACHII, short head			**biceps brachii, short head** O: coracoid I: R			
BICEPS BRACHII, long head	**flx longus cubiti** O: coracoid + glenoid I: R tuberosity	**biceps brachii** O: supraglenoid tubercle I: bicipital tuberosity U	**biceps brachii, long head** O: bicipital process scapula I: medial U w/ B	**biceps brachii** O: coracoid w/ CB + glenoid I: medial ridge U	**biceps brachii** O: coracoid + glenoid I: R tuberosity	**biceps brachii** O: coracoid + glenoid I: R tuberosity

	Anomaluromorpha	**Castorimorpha**			**Sciuromorpha**	
	Pedetidae	**Castoridae**	**Heteromyidae**		**Sciuridae**	
	Pedetes **Parsons, 1898b**	***Castor*** **Young, 1937**	***Dipodomys*** **Howell, 1932**	***Heteromys*** **Ryan, 1989**	***Marmota*** **Bezuidenhout & Evans, 2005**	***Spermophilus*** **Thorington et al, 1997**
BRACHIALIS	**flx brevis cubiti (2 heads)** O: external + internal heads I: U	**brachialis** O: GT I: U	**brachialis** O: medial + lateral neck H I: medial U w/ BBl	**brachialis** O: proximal caudo-lateral H I: brachial crest U	**brachialis** O: caudal H distal to head I: distal to coronoid process U	**brachialis** O: lateral H I: distal to coronoid process U
CUBITALIS						
SUPRASPINATUS		**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT
INFRASPINATUS		**infraspinatus** O: infraspinous fossa I: distal GT	**infraspinatus** O: infraspinous fossa I: lateral GT	**infraspinatus** O: infraspinous fossa I: caudo-lateral GT	**infraspinatus** O: infraspinous fossa I: distal GT	**infraspinatus** O: infraspinous fossa I: distal GT
TRICEPS BRACHII CAPUT LATERALE	**ext longus cubiti** "nothing of interest"	**triceps brachii, lateral head** O: proximal H near GT I: cranio-lateral olecranon	**triceps lateralis** O: lateral head H I: lateral olecranon	**triceps brachii caput lateralis** O: proximal lateral deltoid crest H, lateral GT I: lateral olecranon	**triceps brachii, lateral head** O: GT to deltoid tubercle H I: olecranon	**triceps brachii, lateral head** O: lateral deltoid ridge H I: olecranon
TRICEPS BRACHII CAPUT MEDIALE		**triceps brachii, medial head** O: caudal H I: olecranon	**triceps medialis** O: medial crest H I: lateral olecranon	**triceps brachii caput medialis** O: caudo-medial H I: medial olecranon	**triceps brachii, medial head** O: caudo-medial H I: olecranon	**triceps brachii, medial head** O: caudal H I: tip olecranon
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)		**triceps brachii, long head** O: caudal border scapula I: olecranon	**triceps longus** O: caudal border scapula + aponeurosis from acromion I: olecranon	**triceps brachii caput longus** O: caudal border scapula, tendon from acromion I: olecranon	**triceps brachii, long head** O: caudal border scapula I: olecranon	**triceps brachii, long head** O: caudal border scapula I: tip olecranon

	Anomaluromorpha	Castorimorpha			Sciuromorpha	
	Pedetidae	**Castoridae**	**Heteromyidae**		**Sciuridae**	
	Pedetes **Parsons, 1898b**	***Castor*** **Young, 1937**	***Dipodomys*** **Howell, 1932**	***Heteromys*** **Ryan, 1989**	***Marmota*** **Bezuidenhout & Evans, 2005**	***Spermophilus*** **Thorington et al, 1997**
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)						
TRICEPS BRACHII ACCESSORY					**triceps brachii, accessory head** O: caudo-lateral H w/ TME I: olecranon	
ANCONEUS	**anconeus** "nothing of interest"	**anconeus** O: lateral epicondyle I: lateral olecranon	**triceps anconeus** absent	**anconeus** O: distal caudal H, lateral supracondylar ridge I: lateral olecranon	**anconeus** O: lateral + medial epicondyles I: olecranon	**anconeus** O: caudal lateral epicondyle I: lateral olecranon
BRACHIORADIALIS	**supinator longus** absent		**brachioradialis** absent	**brachioradialis** absent	**brachioradialis** O: lateral epicondyle I: styloid process R	**brachioradialis** O: lateral supracondylar ridge I: distal R
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radiales longior and brevior** "normal"	**brachioradialis** O: lateral epicondyle I: base MC2	**ext carpi radialis longus** O: lateral epicondyle I: base MC2	**ext carpi radialis longus** O: lateral supracondylar ridge H I: base MC2	**ext carpi radialis, medial part** O: lateral epicondyle I: MC2	**ext carpi radialis longus** O: lateral supracondylar ridge I: MC2
EXT CARPI RADIALIS, brevis (MC3)	**ext carpi radiales longior and brevior** "normal"	**ext carpi radialis** O: lateral epicondyle I: multangular	**ext carpi radialis brevis** O: lateral epicondyle I: MC2	**ext carpi radialis brevis** O: lateral supracondylar ridge H I: base MC3	**ext carpi radialis, lateral part** O: lateral epicondyle I: MC3	**ext carpi radialis brevis** O: lateral supracondylar ridge I: MC3
EXT DIGITORUM COMMUNIS	**ext communis digitorum** I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, slip to 5	**ext digitorum** O: lateral supracondylar ridge H I: digits 2, 3, 3, 4, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 3, 4, 5

	Anomaluromorpha	Castorimorpha			Sciuromorpha	
	Pedetidae	Castoridae	Heteromyidae		Sciuridae	
	Pedetes **Parsons, 1898b**	***Castor*** **Young, 1937**	***Dipodomys*** **Howell, 1932**	***Heteromys*** **Ryan, 1989**	***Marmota*** **Bezuidenhout & Evans, 2005**	***Spermophilus*** **Thorington et al, 1997**
EXT DIGITORUM LATERALIS	**ext minimi digiti** I: digit 5	**ext digiti quinti** O: lateral epicondyle I: digit 5	**ext digiti quinti** O: lateral epicondyle I: digit 5	**ext digiti minimi** O: lateral epicondyle I: digits 4, 5	**ext digitorum lateralis** O: lateral epicondyle I: digits 4, 5	**ext digiti quinti proprius** O: lateral epicondyle I: digits 4, 5
EXT CARPI ULNARIS	**ext carpi ulnaris** "normal"	**ext carpi ulnaris** O: lateral epicondyle + U I: MC5	**ext carpi ulnaris** O: lateral epicondyle + olecranon I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: MC5	**ext carpi ulnaris** O: lateral epicondyle I: MC5
SUPINATOR	**supinator brevis** O: sesamoid at lateral epicondyle I: proximal 2/3 R	**supinator** O: lateral epicondyle I: proximal 1/2 medial R	**supinator** O: elbow joint capsule + sesamoid at head R I: medial 1/3 R	**supinator** O: capitulum H + HRj capsule I: proximal R	**supinator** O: lateral epicondyle I: proximal cranio-medial R	**supinator** O: lateral epicondyle I: proximal lateral R
ABD POLLICIS LONGUS	**ext ossis metacarpi pollicis** "normal"	**ext carpi obliquus** O: lateral R + U I: accessory carpal	**ext metacarpi pollicis** O: R + U I: falciform	**abd pollicis longus** O: interosseus membrane + U I: MC1	**abd digiti I longus** O: proximal U I: MC1	**abd pollicis longus** O: lateral U + R I: MC1 + falciform
EXT DIGITORUM PROFUNDUS	**ext indicis** "small" I: digit 2	**ext indicis proprius** O: U I: digits 1, 2	**ext indicis** O: middle U I: digits 1, 2	**ext indicis** O: middle U I: digit 2	**ext digiti II** O: R I: EDC2	**ext indicis** O: lateral U I: digits 1, 2
EXT BREVIS DIGITORUM					**ext digiti III** O: lateral epicondyle I: digit 3	
EXT POLLICIS LONGUS	**ext primi internodii pollicis** absent			**ext digiti tertii proprius** absent		
EXT POLLICIS BREVIS	**ext secundi internodii pollicis** absent			**ext pollicis brevis** absent		
PRONATOR TERES	**pronator radii teres** O: medial epicondyle I: middle R	**pronator teres** O: medial epicondyle I: proximal 1/2 medial R	**pronator teres** O: medial epicondyle I: proximal 1/3 R	**pronator teres** O: medial epicondyle I: proximal R	**pronator teres** O: medial epicondyle I: distal medial R	**pronator teres** O: medial epicondyle I: middle medial R

	Anomaluromorpha	Castorimorpha			Sciuromorpha	
	Pedetidae	**Castoridae**	**Heteromyidae**		**Sciuridae**	
	Pedetes **Parsons, 1898b**	***Castor*** **Young, 1937**	***Dipodomys*** **Howell, 1932**	***Heteromys*** **Ryan, 1989**	***Marmota*** **Bezuidenhout & Evans, 2005**	***Spermophilus*** **Thorington et al, 1997**
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: "usual attachments"	**flx carpi radialis** O: medial epicondyle I: MC2	**flx carpi radialis** O: medial epicondyle I: MC2 + 3	**flx carpi radialis** O: medial epicondyle I: base MC2	**flx carpi radialis** O: medial epicondyle I: MC2 + 3	**flx carpi radialis** O: medial epicondyle I: base MC2
PALMARIS LONGUS	**palmaris longus** O: medial epicondyle + FDS I: falciform + ulnar sesamoid	**palmaris longus** O: medial epicondyle + olecranon I: palmar aponeurosis	**palmaris longus** O: medial epicondyle I: palmar fascia	**palmaris longus** O: distal medial epicondyle I: palmar fascia ulnar side hand	**flx digitorum superficialis** O: medial epicondyle I: palmar fascia + tendon slips w/ FDS	**palmaris longus (u)** O: medial epicondyle w/ FDS I: palmar fascia
FLX DIGITORUM SUPERFICIALIS	**flx sublimis digitorum (u)** O: medial epicondyle I: digits 2f, 3f, 4f, 5f	**flx digitorum sublimis** O: medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum sublimis** O: medial epicondyle I: digits 1, 2, 3, 4	**flx digitorum superficialis** O: medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum superficialis** O: medial epicondyle I: digits 2f, 3f, 4f, 5f	**flx digitorum sublimis (u)** O: medial epicondyle I: digits 2f, 3f, 4f, 5f
INTERFLEXORII						
FLX DIGITORUM PROFUNDUS,	**flx profundus digitorum (m)**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**
epicondylar						
epicondylar (FDPe)	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle
epicondylar (FDPd)	O: medial epicondyle		O: sigmoid border	O: medial epicondyle		O: medial epicondyle
ulnar	O: U	O: U	O: U	O: middle 1/3 U	O: U	O: U
radial	O: R *I: digits 1, 2, 3, 4, 5	O: R *I: digits 1, 2, 3, 4, 5	O: R *I: digits 1, 2, 3, 4, 5	O: proximal 1/3 R *I: digits 1, 2, 3, 4, 5	O: R *I: digits 2, 3, 4, 5	O: R *I: digits 1, 2, 3, 4, 5
LUMBRICALES	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5			**lumbricales** O: FDP I: digits 3, 4, 5	
FLX CARPI ULNARIS, epitrochlear belly		**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris** O: medial epicondyle
ulnar belly		O: olecranon I: pisiform	O: olecranon I: pisiform	O: medial olecranon + U I: pisiform	O: olecranon I: pisiform	O: olecranon I: pisiform
EPITROCHLEO-ANCONEUS	**epitrochleo-anconeus** present "as usual"	**triceps brachii, medial head minor** O: medial epicondyle I: medial olecranon	**epitrochleo-anconeus** O: medial epicondyle I: medial olecranon	**epitrochleoanconeus** O: caudal medial epicondyle I: medial olecranon		**epitrochleo-anconeus** O: medial epicondyle I: medial olecranon

	Anomaluromorpha	Castorimorpha			Sciuromorpha	
	Pedetidae	**Castoridae**	**Heteromyidae**		**Sciuridae**	
	Pedetes **Parsons, 1898b**	***Castor*** **Young, 1937**	***Dipodomys*** **Howell, 1932**	***Heteromys*** **Ryan, 1989**	***Marmota*** **Bezuidenhout & Evans, 2005**	***Spermophilus*** **Thorington et al, 1997**
PRONATOR QUADRATUS	**pronator quadratus** O: distal 1/3 U + R	**pronator quadratus** O: middle 1/3 U + R	**pronator quadratus** "few interosseus fibers"	**pronator quadratus** O: distal 1/5 U + R	**pronator quadratus** O: distal 1/2 U + R	**pronator quadratus** O: distal U + R
PALMARIS BREVIS	**palmaris brevis** O: falciform I: ulnar sesamoid					
FLX DIGITORUM BREVIS MANUS						
ABD DIGITI MINIMI	**abd minimi digiti** I: digit 5	**abd digiti quinti** O: pisiform I: digit 5			**abd digiti V** O: pisiform I: digit 5	
ABD POLLICIS BREVIS	**abd pollicis** I: digit 1	**abd pollicis brevis** O: accessory carpal I: radial sesamoid + digit 1				
CONTRAHENTES	**add pollicis, indicis, et minimi digiti** I: digits 1, 2, 5				**add digiti I** O: carpals I: digits 1L	
FLEXOR BREVES PROFUNDUS	**flx breves** 10	**flx digiti quinti brevis, interossei** 6			**interossei, flx digiti I brevis, abd digiti I brevis** 10	
INTERMETACARPALES						
? Unknown homology					**flx digiti V** O: pisiform I: sesamoid at digit 5	
? Unknown homology					**opp digiti V** O: falciform I: digit 5	**lateral retractor of pouch** O: metacromion I: cheek pouch
RADIAL SESAMOID "PRE-POLLUX"	**present**					
ULNAR SESAMOID						
CARPAL VIBRISSAE						

	Hystricomorpha				Myomorpha	
	Chinchillidae	**Echimyidae**	**Erethizontidae**		**Dipodidae**	
	Chinchilla **Wood & White, 1950**	***Proechimys*** **Woods, 1972**	***Coendou*** **McEvoy, 1982**	***Erethizon*** **McEvoy, 1982**	***Allactaga*** **Howell, 1932**	***Jaculus*** **Howell, 1932**
PANNICULUS CARNOSUS	**panniculus carnosus** O: trunk I: LT + surface pectoralis	**cutaneous maximus** O: dorsal midline + abdomen I: metacromion, spine scapula, deltoid crest H	**cutaneous maximus** I: w/ PS	**cutaneous maximus**	**panniculus carnosus** O: dorsal midline I: proximal pectoral crest w/ PS	**panniculus carnosus** O: dorsal midline I: proximal pectoral crest w/ PS
STERNO-FACIALIS						
STERNOMASTOIDEUS	**sternomastoideus** O: mastoid + paroccipital I: manubrium	**sterno-mastoid** O: mastoid I: manubrium			**sternomastoideus** I: behind EAM I: manubrium	**sternomastoideus** I: behind EAM I: manubrium
CLEIDOMASTOIDEUS	**cleidomastoideus** O: mastoid + lambdoid crest I: middle clavicle	**cleido-mastoid** O: mastoid I: medial clavicle			**cleidomastoideus** O: behind EAM I: clavicle	**cleidomastoideus** I: clavicle
CLAVOTRAPEZIUS	**clavotrapezius** O: lambdoid crest I: lateral clavicle	**cleido-occipitalis** O: lambdoidal crest I: medial clavicle			**clavotrapezius** O: w/ AT I: lateral clavicle	**clavotrapezius** O: behind EAM I: lateral clavicle
CEPHALOHUMERALIS						
ACROMIOTRAPEZIUS	**acromiotrapezius** O: tympanic bulla, C1-T4 I: acromion + spine scapula	**acromiotrapezius** O: skull, C1-T2 I: lateral clavicle, acromion, metacromion, spine scapula	**acromiotrapezius** O: nuchal crest, C1-T2 I: lateral clavicle, acromion, spine scapula	**acromiotrapezius** O: nuchal crest, C1-T2 I: lateral clavicle, acromion, spine scapula	**acromiotrapezius** O: occiput I: spine scapula w/ ST	**acromiotrapezius** O: occiput + auditory bulla I: acromion + spine scapula
AURICULAR SLIP		**spinotrapezius, auricular slip** O: ST I: lateral face				

	Hystricomorpha				Myomorpha	
	Chinchillidae	Echimyidae	Erethizontidae		Dipodidae	
	Chinchilla **Wood & White, 1950**	***Proechimys*** **Woods, 1972**	***Coendou*** **McEvoy, 1982**	***Erethizon*** **McEvoy, 1982**	***Allactaga*** **Howell, 1932**	***Jaculus*** **Howell, 1932**
SPINOTRAPEZIUS	**spinotrapezius** O: T4-L3 I: spine scapula	**spinotrapezius** O: T3-lumbodorsal fascia I: spine scapula	**spinotrapezius** O: w/ AT T2-9 I: spine scapula + auricular slip	**spinotrapezius** O: w/ AT T2-7, lumbodorsal fascia I: spine scapula + auricular slip	**spinotrapezius** I: spine scapula w/ AT	**spinotrapezius** I: spine scapula
RHOMBOIDEUS CAPITIS	**rhomboideus capitis** O: lambdoid crest I: vertebral border scapula	**occipitoscapularis** O: lambdoidal crest I: spine scapula + vertebral border scapula	**occipitoscapularis** O: nuchal crest + ligamentum nuchae	**occipitoscapularis** O: nuchal crest + ligamentum nuchae	**rhomboideus pars capitis** O: mastoid region I: vertebral border scapula	
RHOMBOIDEUS CERVICIS	**rhomboideus** O: lambdoid crest, ligamentum nuchae, T1-4 I: vertebral border scapula	**rhomboideus anterior** O: ligamentum nuchae I: deep surface vertebral border scapula	**r. anterior** O: w/ RO ligamentum nuchae	**r. anterior** O: w/ RO ligamentum nuchae	**rhomboideus pars dorsi** O: occiput I: vertebral border scapula	**rhomboideus** O: occiput + behind EAM I: spine + vertebral border scapula
RHOMBOIDEUS THORACIS		**rhomboideus posterior** O: ligamentum nuchae, T1-2 I: deep surface vertebral border scapula	**r. posterior** O: ligamentum nuchae-T3 I: spine scapula + vertebral border scapula	**r. posterior** O: ligamentum nuchae-T4 I: spine scapula + vertebral border scapula		
OMOTRANSVERSARIUS "metacromion"	**levator claviculae** O: atlas I: metacromion + acromion	**omocervicalis** O: atlas I: metacromion + deltoid crest w/ PC	**omocervicalis** O: atlas I: metacromion w/ PC	**omocervicalis** O: atlas I: metacromion w/ PC	**atlantoscapularis inferior** O: atlas I: AT	**atlantoscapularis inferior** O: atlas I: AT + lateral clavicle
OMOTRANSVERSARIUS		**atlantoscapularis posterior** O: atlas I: spine scapula	**atlantoscapularis posterior** O: atals I: spine scapula	**atlantoscapularis posterior** O: atals I: spine scapula	**atlantoscapularis superior** O: atlas I: w/ SVT	**atlantoscapularis superior** O: atlas I: w/ SVT
OMOHYOIDEUS	**omohyoideus** absent	**omohyoideus** absent			**omohyoideus** O: hyoid I: scapula	**omohyoideus** O: hyoid I: scapula

	Hystricomorpha				Myomorpha	
	Chinchillidae	Echimyidae	Erethizontidae		Dipodidae	
	Chinchilla **Wood & White, 1950**	***Proechimys*** **Woods, 1972**	***Coendou*** **McEvoy, 1982**	***Erethizon*** **McEvoy, 1982**	***Allactaga*** **Howell, 1932**	***Jaculus*** **Howell, 1932**
SERRATUS VENTRALIS CERVICIS	**levator scapulae** O: C2-7 w/ SVT I: vertebral border scapula					
SERRATUS VENTRALIS THORACIS	**serratus anticus** O: ribs 3-9 I: vertebral border scapula	**levator scapulae and serratus anterior** O: C3-7, ribs 1-7 I: deep surface vertebral border scapula	**levator scapulae + serratus anterior** O: C1-7, ribs 1-8 I: deep surface vertebral border scapul	**levator scapulae + serratus anterior** O: C1-7, ribs 1-8 I: deep surface vertebral border scapul	**serratus magnus** O: ribs 2-6 ?	**serratus magnus** O: ribs 2-5 I: vertebral border scapula
CLAVODELTOIDEUS		**clavodeltoideus** O: lateral clavicle I: deltoid crest H	**clavodeltoideus** O: lateral clavicle I: deltoid crest H	**clavodeltoideus** O: lateral clavicle I: deltoid crest H		
ACROMIODELTOIDEUS	**acromiodeltoideus** O: acromion + metacromion I: deltoid crest H	**acromiodeltoideus** O: acromion I: deltoid crest H	**acromiodeltoideus** O: acromion + metacromion I: deltoid crest H	**acromiodeltoideus** O: acromion + metacromion I: deltoid crest H	**deltoideus** O: clavicle, acromion, spine scapula I: deltoid crest H	**deltoideus** O: clavicle, acromion, spine scapula I: deltoid crest H
SPINODELTOIDEUS	**spinodeltoideus** O: spine scapula + fascia IN I: deltoid crest H	**spinodeltoideus** O: spine scapula I: deltoid crest H	**spinodeltoideus** O: spine scapula + fascia IN I: lateral deltoid crest H	**spinodeltoideus** O: spine scapula + fascia IN I: lateral deltoid crest H		
TERES MINOR	**teres minor** O: caudal border scapula I: GT near IN	**teres minor** O: caudal border scapula I: distal GT	**teres minor** O: caudal border scapula I: GT	**teres minor** O: caudal border scapula I: GT	**teres minor** O: caudal border scapula I: GT	**teres minor** O: caudal border scapula I: GT
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT

	Hystricomorpha				Myomorpha	
	Chinchillidae	**Echimyidae**	**Erethizontidae**		**Dipodidae**	
	Chinchilla **Wood & White, 1950**	***Proechimys*** **Woods, 1972**	***Coendou*** **McEvoy, 1982**	***Erethizon*** **McEvoy, 1982**	***Allactaga*** **Howell, 1932**	***Jaculus*** **Howell, 1932**
TERES MAJOR	**teres major** O: caudal angle scapula I: medial deltoid ridge H w/ LD	**teres major** O: caudal angle scapula I: medial H near LT w/ LD	**teres major** O: caudal border scapula I: medial H	**teres major** O: caudal border scapula I: medial H	**teres major** O: caudal angle scapula I: proximal medial crest H	**teres major** O: caudal angle scapula I: proximal medial crest H
LATISSIMUS DORSI "superficial" "deep"	**latissimus dorsi** O: T8-12, ribs 9-12 I: medial deltoid ridge H w/ TMA	**latissimus dorsi** O: caudal 5T, lumbodorsal fascia I: medial H near LT w/ TMA I: fascia PP	**latissimus dorsi** O: lumbodorsal fascia, ribs 12-14 I: medial H	**latissimus dorsi** O: lumbodorsal fascia, ribs 11-15 I: medial H * Aschelbogen	**latissimus dorsi** O: dorsal fadscia I: TMA tendon	**latissimus dorsi** O: dorsal fadscia I: TMA tendon
DORSO-EPITROCHLEARIS	**epitrochleoanconeus** O: neck H near insertion LD I: medial olecranon	**dorsoepitrochlearis** O: LD I: olecranon	**dorsoepitrochlearis** O: LD I: medial olecranon + fascia forearm	**dorsoepitrochlearis** O: LD I: medial olecranon + fascia forearm	**dorso-epitrochlearis** O: scapula I: medial olecranon	**dorso-epitrochlearis** O: scapula + TMA + LD I: medial olecranon
PECTORALIS SUPERFICIALIS "clavicular"						
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis, anterior superficial** O: clavicle + sternum I: deltoid process H	**pectoralis major** O: manubrium + sternum I: deltoid crest H	**pectoralis major** O: manubrium + sternum I: medial deltoid crest H	**pectoralis major** O: manubrium + sternum I: medial deltoid crest H		**pectoral, superficial** O: manubrium + sternum I: proximal deltoid process H
PECTORALIS SUPERFICIALIS "deep"	**pectoralis, posterior superficial** O: sternum I: deltoid process H					
PECTORALIS PROFUNDUS	**pectoralis, deep** O: sternum I: lateral clavicle	**pectoralis minor** O: sternum I: clavicle // GT + coracoid + deltoid ridge H	**pectoralis minor** O: sternum, ribs 3-7 I: proximal H	**pectoralis minor** O: sternum, ribs 3-7 I: coracoid, medial GT + medial deltoid crest H		**pectoral, deep** O: deep to PSs

	Hystricomorpha				Myomorpha	
	Chinchillidae	**Echimyidae**	**Erethizontidae**		**Dipodidae**	
	Chinchilla **Wood & White, 1950**	***Proechimys*** **Woods, 1972**	***Coendou*** **McEvoy, 1982**	***Erethizon*** **McEvoy, 1982**	***Allactaga*** **Howell, 1932**	***Jaculus*** **Howell, 1932**
PECTORALIS ABDOMINALIS	**pectoralis, abdominal** O: xiphoid + linea alba I: base deltoid process H	**pectoralis abdominalis** O: xiphisternum I: LT	**pectoralis abdominalis** O: xiphisternum I: proximal deltoid crest H	**pectoralis abdominalis** O: xiphisternum + linea alba I: medial deltoid crest H		
SUBCLAVIUS	**subclavius** O: rib 1 I: lateral clavicle	**subclavius** O: rib 1 I: clavicle	**subclavius** O: manubrium + rib 1 I: lateral clavicle	**subclavius** O: manubrium + rib 1 I: clavicle	**subclavius** O: rib 1 I: clavicle	**subclavius** O: rib 1 I: clavicle
STERNOSCAPULARIS	**scapulo-clavicularis** O: clavicle + sternum I: spine scapula	**scapuloclavicularis** O: clavicle I: vertebral border + spine scapula	**scapuloclavicularis** O: lateral clavicle I: vertebral border + spine scapula	**scapuloclavicularis** O: lateral clavicle I: vertebral border + spine scapula	**scapuloclavicularis** absent	**scapuloclavicularis** absent
CORACOBRACHIALIS	**coracobrachialis** O: coracoid I: distal medial H	**coracobrachialis** O: coracoid w/ BBs I: middle medial H	**coracobrachialis middle part** O: coracoid I: distal medial H	**coracobrachialis middle part** O: coracoid I: distal medial H	**coracobrachialis pars media** O: coracoid I: H to medial epicondyle	**coracobrachialis pars media** O: coracoid I: H to medial epicondyle
CORACOBRACHIALIS			**coracobrachialis long part** O: coracoid I: distal medial H			
BICEPS BRACHII, short head						
BICEPS BRACHII, long head	**biceps brachii** O: coracoid + glenoid I: R tuberosity + coronoid process U	**biceps brachii** O: coracoid w/ CB + glenoid I: brachial ridge U + R	**biceps brachii** O: coracoid + glenoid I: proximal U + R tuberosity	**biceps brachii** O: coracoid + glenoid I: proximal U + R tuberosity	**biceps brachii, long head** O: bicipital process scapula I: medial U w/ B	**biceps brachii, long head** O: bicipital process scapula I: medial U w/ B

	Hystricomorpha				Myomorpha	
	Chinchillidae	Echimyidae	Erethizontidae		Dipodidae	
	Chinchilla **Wood & White, 1950**	***Proechimys*** **Woods, 1972**	***Coendou*** **McEvoy, 1982**	***Erethizon*** **McEvoy, 1982**	***Allactaga*** **Howell, 1932**	***Jaculus*** **Howell, 1932**
BRACHIALIS	**brachialis** O: caudal neck H I: brachial ridge U	**brachialis (2 heads)** O: caudal neck H + deltoid ridge H I: brachial ridge U	**brachialis (2 heads)** O: caudo-lateral neck H + deltoid crest H I: brachial ridge U	**brachialis (2 heads)** O: caudo-lateral neck H + deltoid crest H I: brachial ridge U	**brachialis** O: medial + lateral neck H I: medial U w/ BBl	**brachialis** O: medial + lateral neck H I: medial U w/ BBl
CUBITALIS						
SUPRASPINATUS	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus (divided)** O: supraspinous fossa I: GT	**supraspinatus (divided)** O: supraspinous fossa I: GT	**supraspinatus (divided)** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT
INFRASPINATUS	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: lateral GT	**infraspinatus** O: infraspinous fossa I: lateral GT
TRICEPS BRACHII CAPUT LATERALE	**triceps brachii, lateral head** O: lateral neck H I: olecranon w/ TLO	**triceps brachii, caput lateralis** O: lateral GT + deltoid ridge H I: lateral olecranon	**triceps brachii caput lateralis** O: caudo-lateral GT I: lateral olecranon	**triceps brachii caput lateralis** O: caudo-lateral GT I: lateral olecranon	**triceps lateralis** O: caudal head H I: lateral olecranon	**triceps lateralis** O: caudo-lateral head H I: lateral olecranon
TRICEPS BRACHII CAPUT MEDIALE	**triceps brachii, medial head** O: caudal H I: olecranon	**triceps brachii, caput medialis superficial part** O: caudo-medial H I: olecranon	**triceps brachii caput medialis superficial part** O: distal caudo-medial H I: medial olecranon	**triceps brachii caput medialis superficial part** O: distal caudo-medial H I: medial olecranon	**triceps medialis** O: medial crest H I: lateral olecranon	**triceps medialis** O: medial crest H I: lateral olecranon
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps brachii, long head** O: caudal border scapula I: olecranon w/ TLA	**triceps brachii, caput longus** O: caudal border scapula + "aponeurotic origin" I: olecranon	**triceps brachii caput longus** O: caudal border scapula I: olecranon	**triceps brachii caput longus** O: caudal border scapula I: olecranon	**triceps longus** O: caudal border scapula I: olecranon	**triceps longus** O: caudal border scapula I: olecranon

	Hystricomorpha				Myomorpha	
	Chinchillidae	Echimyidae	Erethizontidae		Dipodidae	
	Chinchilla **Wood & White, 1950**	***Proechimys*** **Woods, 1972**	***Coendou*** **McEvoy, 1982**	***Erethizon*** **McEvoy, 1982**	***Allactaga*** **Howell, 1932**	***Jaculus*** **Howell, 1932**
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)						
TRICEPS BRACHII ACCESSORY		**triceps brachii, caput medialis superficial part** "incompletely divided"	**triceps brachii caput medialis deep part** O: caudo-lateral H I: olecranon	**triceps brachii caput medialis deep part** O: caudo-lateral H I: olecranon		
ANCONEUS		**anconeus** O: distal caudo-lateral H + lateral epicondyle I: lateral olecranon	**anconeus** O: w/ TME I: lateral U	**anconeus** O: distal caudo-lateral H + lateral epicondyle I: lateral U	**triceps anconeus** absent	**triceps anconeus** absent
BRACHIORADIALIS		**brachioradialis** absent	**brachioradialis** O: lateral supracondylar ridge H I: distal R near styloid process	**brachioradialis** O: lateral supracondylar ridge H I: distal R near styloid process	**brachioradialis** I: distal medial R	**brachioradialis** I: base digit 1
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis longus** O: lateral epicondyle I: middle MC2	**ext carpi radialis longus** O: lateral supracondylar ridge H I: proximal MC2	**ext carpi radialis longus** O: lateral supracondylar ridge H I: middle MC2	**ext carpi radialis longus** O: lateral supracondylar ridge H I: middle MC2	**ext carpi radialis longus** O: lateral epicondyle I: medial MC2	**ext carpi radialis longus** O: lateral epicondyle I: medial MC2
EXT CARPI RADIALIS, brevis (MC3)	**ext carpi radialis brevis** O: lateral epicondyle I: middle MC3	**ext carpi radialis brevis** O: lateral supracondylar ridge H I: proximal MC3	**ext carpi radialis brevis** O: lateral supracondylar ridge H I: MC3	**ext carpi radialis brevis** O: lateral supracondylar ridge H I: MC3	**ext carpi radialis brevis** O: lateral epicondyle I: MC2	**ext carpi radialis brevis** O: lateral epicondyle I: MC2
EXT DIGITORUM COMMUNIS		**ext digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5

	Hystricomorpha				Myomorpha	
	Chinchillidae	Echimyidae	Erethizontidae		Dipodidae	
	Chinchilla **Wood & White, 1950**	***Proechimys*** **Woods, 1972**	***Coendou*** **McEvoy, 1982**	***Erethizon*** **McEvoy, 1982**	***Allactaga*** **Howell, 1932**	***Jaculus*** **Howell, 1932**
EXT DIGITORUM LATERALIS	**ext digiti minimus** O: lateral epicondyle I: digit 5	**ext digiti minimi** O: lateral epicondyle I: digits 4, 5	**ext digiti minimi +** O: EDC + lateral epicondyle I: digits 4, 5	**ext digiti minimi** O: EDC + lateral epicondyle I: digits 4, 5	**ext digiti quinti** O: lateral epicondyle I: digits 4, 5	**ext digiti quinti** O: lateral epicondyle I: digit 5
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: distal lateral epicondyle + U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + lateral U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + lateral U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5
SUPINATOR	**supinator brevis** O: lateral epicondyle I: proximal 1/3 R	**supinator** O: lateral epicondyle + radial collateral ligament I: proximal 1/2 lateral R	**supinator** O: lateral epicondyle + annular ligament R I: proximal lateral R	**supinator** O: lateral epicondyle + annular ligament R I: proximal lateral R	**supinator** O: lateral epicondyle	**supinator** O: lateral epicondyle + head R
ABD POLLICIS LONGUS	**abd pollicis longus** O: distal R + U I: base MC1	**abd pollicis longus** O: proximal R + U I: base MC1 + falciform	**abd pollicis longus** O: U + interosseous membrane I: base MC1 + falciform	**abd pollicis longus** O: U + interosseous membrane I: base MC1 + falciform	**ext metacarpi pollicis** O: R + U I: falciform + MC1	**ext metacarpi pollicis** O: R + U I: falciform
EXT DIGITORUM PROFUNDUS	**ext indicis proprius** O: middle U I: EDC2	**ext indicis** O: middle U I: digits 1, 2	**ext indicis** O: U I: digits 1, 2	**ext indicis** O: U I: digits 1, 2	**ext indicis** O: middle U I: digit 2	**ext indicis** O: middle U I: digits 1, 2
EXT BREVIS DIGITORUM						
EXT POLLICIS LONGUS	**ext pollicis longus** absent	**ext digiti tertii proprius** absent	**ext digiti tertii proprius** O: EDC + lateral epicondyle I: digit 3			
EXT POLLICIS BREVIS		**ext pollicis brevis** absent	**ext pollicis brevis** absent	**ext pollicis brevis** absent		
PRONATOR TERES	**pronator teres** O: medial epicondyle I: middle R	**pronator teres** O: medial epicondyle I: proximal cranio-medial R	**pronator teres** O: medial epicondyle I: cranio-medial R	**pronator teres** O: medial epicondyle I: cranio-medial R	**pronator teres** O: medial epicondyle I: proximal 1/3 R	**pronator teres** O: medial epicondyle I: proximal 1/3 R

	Hystricomorpha				Myomorpha	
	Chinchillidae	**Echimyidae**	**Erethizontidae**		**Dipodidae**	
	Chinchilla **Wood & White, 1950**	***Proechimys*** **Woods, 1972**	***Coendou*** **McEvoy, 1982**	***Erethizon*** **McEvoy, 1982**	***Allactaga*** **Howell, 1932**	***Jaculus*** **Howell, 1932**
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: MC2 + slip to MC3	**flx carpi radialis** O: medial epicondyle I: base MC2 + 3	**flx carpi radialis** O: medial epicondyle I: base MC2 + 3	**flx carpi radialis** O: medial epicondyle I: base MC2 + 3	**flx carpi radialis** O: medial epicondyle I: MC2 + 3	**flx carpi radialis** O: medial epicondyle I: MC2 + 3
PALMARIS LONGUS	**palmaris longus** absent >see medial epicondyle origin FCU (Woods, 1972)	**palmaris longus (u)** O: distal medial epicondyle + olecranon I: falciform + palmar fascia + cartilage	**palmaris longus** O: distal medial epicondyle I: falciform + palmar fascia + cartilage	**palmaris longus** O: distal medial epicondyle I: falciform + palmar fascia + cartilage	**palmaris longus** O: medial epicondyle I: palmar fascia	**palmaris longus** O: medial epicondyle I: palmar fascia
FLX DIGITORUM SUPERFICIALIS	**flx digitorum sublimis** O: medial epicondyle w/ FDP I: digits 2f, 3f, 4f, 5	**flx digitorum superficialis (u)** O: medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum superficialis** O: distal medial epicondyle I: digits 2f, 3f, 4f, 5f	**flx digitorum superficialis** O: distal medial epicondyle I: digits 2f, 3f, 4f, 5f	**flx digitorum sublimis** O: medial epicondyle I: digits 2, 3, 4	**flx digitorum sublimis** O: medial epicondyle I: digits 2, 3, 4
INTERFLEXORII						
FLX DIGITORUM PROFUNDUS,	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**
epicondylar						
epicondylar (FDPe)	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle
epicondylar (FDPd)	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle	O: sigmoid border	O: sigmoid border
ulnar	O: U	O: U	O: U	O: U	O: U	O: U
radial	O: R *I: digits 2, 3, 4, 5	O: R *I: digits 2, 3, 4, 5	O: R *I: digits 2, 3, 4, 5	O: R *I: digits 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	O: R *I: digits 1, 2, 3, 4, 5
LUMBRICALES	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbrical** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5		
FLX CARPI ULNARIS, epitrochlear belly	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris**	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris**	**flx carpi ulnaris**
ulnar belly	O: olecranon I: pisiform	O: olecranon I: pisiform	O: medial olecranon I: pisiform	O: medial olecranon I: pisiform	O: olecranon I: pisiform	O: olecranon I: pisiform
EPITROCHLEO-ANCONEUS	**anconeus** O: medial epicondyle I: medial olecranon	**epitrochleo-anconeus** O: medial epicondyle I: medial olecranon	**epitrochleoanconeus** O: caudal medial epicondyle I: olecranon	**epitrochleoanconeus** O: caudal medial epicondyle I: olecranon	**epitrochleo-anconeus** O: medial epicondyle I: medial olecranon	**epitrochleo-anconeus** O: medial epicondyle I: medial olecranon

	Hystricomorpha				Myomorpha	
	Chinchillidae	Echimyidae	Erethizontidae		Dipodidae	
	Chinchilla **Wood & White, 1950**	***Proechimys*** **Woods, 1972**	***Coendou*** **McEvoy, 1982**	***Erethizon*** **McEvoy, 1982**	***Allactaga*** **Howell, 1932**	***Jaculus*** **Howell, 1932**
PRONATOR QUADRATUS	**pronator quadratus** O: distal 2/3 U + R	**pronator quadratus** O: distal 1/3 U + R	**pronator quadratus** O: distal 1/4 U + R	**pronator quadratus** O: distal 1/4 U + R	**pronator quadratus** "few interosseus fibers"	**pronator quadratus** "few interosseus fibers"
PALMARIS BREVIS						
FLX DIGITORUM BREVIS MANUS						
ABD DIGITI MINIMI	**abd digiti minimi** O: pisiform I: digit 5					
ABD POLLICIS BREVIS	**abd pollicis brevis** O: palmar cartilage I: digit 1					
CONTRAHENTES	**add pollicis** O: MC3 I: digits 1L					
FLEXOR BREVES PROFUNDUS	**flx digiti quinti brevis, interossei** 9					
INTERMETACARPALES						
? Unknown homology						
? Unknown homology						
RADIAL SESAMOID "PRE-POLLUX"		present	present	present		
ULNAR SESAMOID						
CARPAL VIBRISSAE						

	Myomorpha continued						
	Cricetidae						Muridae
	Myodes **Stein, 1986**	***Neotoma*** **Rinker, 1954**	***Ondatra*** **Kesner, 1986**	***Oryzomys*** **Rinker, 1954**	***Peromyscus*** **Rinker, 1954**	***Sigmodon*** **Rinker, 1954**	***Rattus*** **Greene, 1935**
PANNICULUS CARNOSUS		**cutaneus maximus** O: thorax + abdomen I: lateral ridge H		**cutaneus maximus** O: thorax + abdomen I: lateral ridge H	**cutaneus maximus** O: thorax + abdomen I: lateral ridge H	**cutaneus maximus** O: thorax + abdomen I: lateral ridge H	**cutaneus maximus** O: trunk I: LT + surface pectoralis
STERNO-FACIALIS							
STERNOMASTOIDEUS		**sternomastoideus** O: tubercle near EAM w/ CM + mastoid I: manubrium + medial clavicle		**sternomastoideus** O: tubercle near EAM w/ CM I: manubrium + medial clavicle	**sternomastoideus** O: tubercle near EAM w/ CM I: manubrium + medial clavicle	**sternomastoideus** O: tubercle near EAM w/ CM I: manubrium + medial clavicle	**sternomastoideus** O: mastoid + paroccipital I: manubrium
CLEIDOMASTOIDEUS		**cleidomastoideus** O: tubercle near EAM w/ SM + mastoid I: medial clavicle		**cleidomastoideus** O: tubercle near EAM w/ SM + mastoid I: medial clavicle	**cleidomastoideus** O: tubercle near EAM w/ SM + mastoid I: medial clavicle	**cleidomastoideus** O: tubercle near EAM w/ SM I: medial clavicle	**cleidomastoideus** O: mastoid I: middle clavicle
CLAVOTRAPEZIUS	**cleidoccipitalis**	**cleido-occipitalis** O: nuchal crest I: middle clavicle		**cleido-occipitalis** O: lambdoidal crest I: middle clavicle	**cleido-occipitalis** O: nuchal crest I: middle clavicle	**cleido-occipitalis** O: lambdoidal crest I: middle clavicle	**clavotrapezius** O: nuchal crest I: lateral clavicle
CEPHALOHUMERALIS							
ACROMIOTRAPEZIUS	**acromiotrapezius** O: nuchal crest + dorsal midline I: metacromion + spine scapula	**acromiotrapezius** O: occiput, C1-T2 I: acromion + spine scapula		**acromiotrapezius** O: occiput, C1-T2 I: lateral clavicle, acromion, spine scapula	**acromiotrapezius** O: occiput, C1-T2 I: acromion + spine scapula	**acromiotrapezius** O: occiput, C1-T2 I: lateral clavicle, acromion, spine scapula	**acromiotrapezius** O: C1-T4 I: acromion + spine scapula
AURICULAR SLIP	**spinotrapezius pars auris** present	**spinotrapezius** "reduced to fascia"		**spinotrapezius** O: lateral ST I: behind ear	**spinotrapezius** "reduced"	**spinotrapezius** O: lateral ST I: behind ear	

	Myomorpha continued						
	Cricetidae						Muridae
	Myodes **Stein, 1986**	***Neotoma*** **Rinker, 1954**	***Ondatra*** **Kesner, 1986**	***Oryzomys*** **Rinker, 1954**	***Peromyscus*** **Rinker, 1954**	***Sigmodon*** **Rinker, 1954**	***Rattus*** **Greene, 1935**
SPINOTRAPEZIUS	**spinotrapezius** O: T7-8, Tll-L1 I: spine scapula	**spinotrapezius** O: T7-L3 I: spine scapula		**spinotrapezius** O: T7-L3 I: spine scapula	**spinotrapezius** O: T7-L3 I: spine scapula	**spinotrapezius** O: T7-L3 I: spine scapula	**spinotrapezius** O: T4-L3 I: spine scapula
RHOMBOIDEUS CAPITIS	**occipitoscapularis** O: lambdoidal crest I: cranial vertebral border scapula	**occipitoscapularis** O: lambdoidal crest I: spine + vertebral border scapula		**occipitoscapularis** O: lambdoidal crest I: spine + vertebral border scapula	**occipitoscapularis** O: lambdoidal crest I: spine + vertebral border scapula	**occipitoscapularis** O: lambdoidal crest I: spine + vertebral border scapula	**occipitoscapularis** O: lambdoidal ridge I: spine scapula + vertebral border scapula
RHOMBOIDEUS CERVICIS	**rhomboideus anterior** O: ligamentum nuchae I: vertebral border scapula	**rhomboideus anterior** O: C2-T1 I: vertebral border scapula		**rhomboideus anterior** O: ligamentum nuchae I: vertebral border scapula	**rhomboideus anterior** O: C2-T1 I: vertebral border scapula	**rhomboideus anterior** O: ligamentum nuchae I: vertebral border scapula	**r. minor** O: C1-3 I: vertebral border scapula
RHOMBOIDEUS THORACIS	**rhomboideus posterior** O: ligamentum nuchae I: vertebral border scapula	**rhomboideus posterior** O: T2 I: vertebral border scapula		**rhomboideus posterior** O: caudal ligamentum nuchae-T2 I: vertebral border scapula	**rhomboideus posterior** O: T2 I: vertebral border scapula	**rhomboideus posterior** O: caudal ligamentum nuchae-T2 I: vertebral border scapula	**r. major** O: T4-7 I: vertebral border scapula
OMOTRANSVERSARIUS "metacromion"	**omocervicalis** O: atlas I: metacromion	**omocervicalis** O: atlas I: metacromion		**omocervicalis** O: atlas I: metacromion	**omocervicalis** O: atlas I: metacromion	**omocervicalis** O: atlas I: metacromion	**levator claviculae** O: atlas + basioccipital I: metacromion
OMOTRANSVERSARIUS							
OMOHYOIDEUS		**omohyoideus** O: hyoid I: cranial border neck scapula		**omohyoideus** O: hyoid I: cranial border neck scapula	**omohyoideus** O: hyoid I: cranial border neck scapula	**omohyoideus** O: hyoid I: cranial border neck scapula	**omohyoideus** O: hyoid I: cranial border scapula

	Myomorpha continued						
	Cricetidae						Muridae
	Myodes **Stein, 1986**	***Neotoma*** **Rinker, 1954**	***Ondatra*** **Kesner, 1986**	***Oryzomys*** **Rinker, 1954**	***Peromyscus*** **Rinker, 1954**	***Sigmodon*** **Rinker, 1954**	***Rattus*** **Greene, 1935**
SERRATUS VENTRALIS CERVICIS							**levator scapulae** O: C4-7 I: deep surface vertebral border scapula w/ SVT
SERRATUS VENTRALIS THORACIS	**levator scapulae and serratus anterior** O: C2-7, ribs 1-8 I: vertebral border scapula	**levator scapulae and serratus anterior** O: C5-7, ribs 1-8 I: vertebral border scapula		**levator scapulae and serratus anterior** O: C5-7, ribs 1-8 I: vertebral border scapula	**levator scapulae and serratus anterior** O: C5-7, ribs 1-8 I: vertebral border scapula	**levator scapulae and serratus anterior** O: C5-7, ribs 1-8 I: vertebral border scapula	**serratus anterior** O: ribs 1-7 I: deep surface vertebral border scapula
CLAVODELTOIDEUS							
ACROMIODELTOIDEUS	**clavoacromiodeltoideus** O: clavicle + acromion I: deltoid crest H	**clavo-acromiodeltoideus** O: clavicle + acromion I: deltoid crest H + SD		**clavo-acromiodeltoideus** O: clavicle + acromion I: deltoid crest H + SD	**clavo-acromiodeltoideus** O: clavicle + acromion I: deltoid crest H + SD	**clavo-acromiodeltoideus** O: clavicle + acromion I: deltoid crest H + SD	**acromiodeltoideus** O: lateral clavicle + acromion I: deltoid ridge H
SPINODELTOIDEUS	**spinodeltoideus** O: spine scapula + metacromion I: deltoid crest H	**spinodeltoideus** O: spine scapula + fascia IN I: caudal deltoid crest H		**spinodeltoideus** O: spine scapula + fascia IN I: caudal deltoid crest H	**spinodeltoideus** O: spine scapula I: caudal deltoid crest H	**spinodeltoideus** O: spine scapula + fascia IN I: caudal deltoid crest H	**spinodeltoideus** O: spine scapula + fascia IN I: deltoid ridge H
TERES MINOR	**teres minor** O: caudal border scapula I: GT	**teres minor** O: caudal border scapula I: GT distal to IN		**teres minor** O: caudal border scapula I: GT distal to IN	**teres minor** O: caudal border scapula I: GT distal to IN	**teres minor** O: caudal border scapula I: GT distal to IN	**teres minor** O: caudal border scapula I: GT distal to IN
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT		**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT

	Myomorpha continued						
	Cricetidae						Muridae
	Myodes **Stein, 1986**	***Neotoma*** **Rinker, 1954**	***Ondatra*** **Kesner, 1986**	***Oryzomys*** **Rinker, 1954**	***Peromyscus*** **Rinker, 1954**	***Sigmodon*** **Rinker, 1954**	***Rattus*** **Greene, 1935**
TERES MAJOR	**teres major** O: caudal angle + border scapula I: H distal to LT w/ LD	**teres major** O: caudal border scapula O: proximal medial H		**teres major** O: caudal border scapula I: tendon LD	**teres major** O: caudal border scapula O: proximal medial H	**teres major** O: caudal border scapula I: tendon LD	**teres major** O: caudal border scapula I: medial H
LATISSIMUS DORSI "superficial" "deep"	**latissimus dorsi** O: T8-L1 I: H distal to LT w/ TMA	**latissimus dorsi** O: T7-11, lumbodorsal fascia I: proximal medial H I: GT		**latissimus dorsi** O: T7-11, lumbodorsal fascia I: proximal medial H	**latissimus dorsi** O: T7-11, lumbodorsal fascia I: proximal medial H I: GT	**latissimus dorsi** O: T7-11, lumbodorsal fascia I: proximal medial H	**latissimus dorsi** O: T8-12, dorso-lumbar fascia I: proximal medial deltoid ridge H
DORSO-EPITROCHLEARIS	**dorsoepitrochlearis** O: LD I: medial tip olecranon	**dorsoepitrochlearis** O: LD + GT I: caudo-medial olecranon		**dorsoepitrochlearis** O: LD I: caudo-medial olecranon	**dorsoepitrochlearis** O: LD + GT I: caudo-medial olecranon	**dorsoepitrochlearis** O: LD I: caudo-medial olecranon	**epitrochleoanconeus (u) *** O: LD I: medial epicondyle
PECTORALIS SUPERFICIALIS "clavicular"							
PECTORALIS SUPERFICIALIS "superficial"		**pectoralis major** O: manubrium + sternum I: lateral ridge H		**pectoralis major, superficial** O: manubrium I: distal lateral ridge H	**pectoralis major, superficial** O: manubrium I: distal lateral ridge H	**pectoralis major, superficial** O: manubrium I: distal lateral ridge H	**pectoralis major, superficial portion** O: manubrium + sternum I: deltoid ridge H
PECTORALIS SUPERFICIALIS "deep"				**pectoralis major, deep** O: manubrium + sternum I: lateral crest H	**pectoralis major, deep** O: manubrium + sternum I: lateral crest H	**pectoralis major, deep** O: manubrium + sternum I: lateral crest H	**pectoralis major, deep portion** O: manubrium + sternum I: distal deltoid ridge H
PECTORALIS PROFUNDUS		**pectoralis minor, posterior** O: xiphisternum I: lateral ridge H w/ PC		**pectoralis minor, posterior** O: xiphisternum I: lateral ridge H w/ PC	**pectoralis minor, posterior** O: xiphisternum I: lateral ridge H w/ PC	**pectoralis minor, posterior** O: xiphisternum I: lateral ridge H w/ PC	**pectoralis minor, second portion** O: sternum I: proximal deltoid ridge H

	Myomorpha continued						
	Cricetidae						Muridae
	Myodes **Stein, 1986**	***Neotoma*** **Rinker, 1954**	***Ondatra*** **Kesner, 1986**	***Oryzomys*** **Rinker, 1954**	***Peromyscus*** **Rinker, 1954**	***Sigmodon*** **Rinker, 1954**	***Rattus*** **Greene, 1935**
PECTORALIS ABDOMINALIS		**pectoralis abdominalis** O: xiphoid + linea alba I: coracoclavicular ligament + clavicle		**pectoralis abdominalis** O: xiphoid + linea alba I: LT	**pectoralis abdominalis** O: xiphoid + linea alba I: lateral bicipital groove w/ PP	**pectoralis abdominalis** O: xiphoid + linea alba I: LT	**pectoralis minor, third portion** O: xiphoid process I: coracoid process
SUBCLAVIUS		**subclavius** O: rib 1 I: clavicle		**subclavius** O: rib 1 I: clavicle	**subclavius** O: rib 1 I: clavicle	**subclavius** O: rib 1 I: clavicle	**subclavius** O: rib 1 I: middle clavicle
STERNOSCAPULARIS		**pectoralis minor, anterior** O: sternum + xiphisternum I: GHj capsule + clavicle + proximal lateral ridge H		**pectoralis minor, anterior** O: sternum + xiphisternum I: GHj capsule + clavicle + proximal lateral ridge H	**pectoralis minor, anterior** O: sternum + xiphisternum I: GHj capsule + proximal lateral ridge H	**pectoralis minor, anterior** O: sternum + xiphisternum I: GHj capsule + proximal lateral ridge H	**pectoralis minor, first portion** O: sternum I: coracoid + LT
CORACOBRACHIALIS	**coracobrachialis** O: coracoid w/ BBs I: distal medial H	**coracobrachialis** O: coracoid I: distal medial H		**coracobrachialis** O: coracoid I: distal medial H	**coracobrachialis** O: coracoid I: distal medial H	**coracobrachialis** O: coracoid w/ BBs I: distal medial H	**coracobrachialis** O: coracoid w/ BBs I: distal H
CORACOBRACHIALIS		**coracobrachialis** O: coracoid I: proximal medial H			**coracobrachialis** O: coracoid I: proximal medial H		
BICEPS BRACHII, short head							
BICEPS BRACHII, long head	**biceps brachii** O: coracoid w/ CB + glenoid I: brachial ridge U w/ B, slip to R tuberosity	**biceps brachii** O: coracoid w/ CB + glenoid I: R tuberosity + brachial ridge U		**biceps brachii** O: coracoid w/ CB + glenoid I: R tuberosity + brachial ridge U	**biceps brachii** O: coracoid w/ CB + glenoid I: R tuberosity	**biceps brachii** O: coracoid w/ CB + glenoid I: R tuberosity	**biceps brachii** O: coracoid w/ CB + glenoid I: R tuberosity + lacertus fibrosus

	Myomorpha continued						
	Cricetidae						Muridae
	Myodes **Stein, 1986**	***Neotoma*** **Rinker, 1954**	***Ondatra*** **Kesner, 1986**	***Oryzomys*** **Rinker, 1954**	***Peromyscus*** **Rinker, 1954**	***Sigmodon*** **Rinker, 1954**	***Rattus*** **Greene, 1935**
BRACHIALIS	**brachialis** O: caudal neck H I: brachial ridge U w/ BB	**brachialis (2 heads)** O: caudal medial + lateral H I: brachial ridge U		**brachialis (2 heads)** O: caudal medial + lateral H I: brachial ridge U	**brachialis (2 heads)** O: caudal medial + lateral H I: brachial ridge U	**brachialis (2 heads)** O: caudal medial + lateral H I: brachial ridge U	**brachialis** O: GT + neck H I: distal to coronoid process U
CUBITALIS							
SUPRASPINATUS	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus (divided)** O: supraspinous fossa I: GT		**supraspinatus (divided)** O: supraspinous fossa I: GT	**supraspinatus (divided)** O: supraspinous fossa I: GT	**supraspinatus (divided)** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: head H
INFRASPINATUS	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: distal GT		**infraspinatus** O: infraspinous fossa I: distal GT	**infraspinatus** O: infraspinous fossa I: distal GT	**infraspinatus** O: infraspinous fossa I: distal GT	**infraspinatus** O: infraspinous fossa I: GT
TRICEPS BRACHII CAPUT LATERALE	**triceps brachii caput lateralis** O: GT + deltoid crest H I: lateral olecranon	**triceps brachii, caput lateralis** O: GT proximal deltoid crest H I: lateral olecranon		**triceps brachii, caput lateralis** O: GT proximal deltoid crest H I: lateral olecranon	**triceps brachii, caput lateralis** O: GT proximal deltoid crest H I: lateral olecranon	**triceps brachii, caput lateralis** O: GT proximal deltoid crest H I: lateral olecranon	**triceps brachii, lateral head** O: GT I: olecranon
TRICEPS BRACHII CAPUT MEDIALE	**triceps brachii caput medialis** O: caudal H + lateral epicondyle I: olecranon	**triceps brachii, caput medialis** O: caudo-medial H I: olecranon		**triceps brachii, caput medialis** O: caudo-medial H I: olecranon	**triceps brachii, caput medialis** O: caudo-medial H I: olecranon	**triceps brachii, caput medialis** O: caudo-medial H I: olecranon	**triceps brachii, medial head** O: proximal H I: olecranon
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps brachii caput longus** O: caudal border scapula, tendon from acromion I: olecranon	**triceps brachii, caput longum** O: caudal border scapula I: olecranon		**triceps brachii, caput longum** O: caudal border scapula + aponeurosis I: olecranon	**triceps brachii, caput longum** O: caudal border scapula I: olecranon	**triceps brachii, caput longum** O: caudal border scapula + aponeurosis I: olecranon	**triceps brachii, long head** O: caudal border scapula I: olecranon

	Myomorpha continued						
	Cricetidae						Muridae
	Myodes **Stein, 1986**	***Neotoma*** **Rinker, 1954**	***Ondatra*** **Kesner, 1986**	***Oryzomys*** **Rinker, 1954**	***Peromyscus*** **Rinker, 1954**	***Sigmodon*** **Rinker, 1954**	***Rattus*** **Greene, 1935**
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)							
TRICEPS BRACHII ACCESSORY							
ANCONEUS	**anconeus** w/ TME	**anconeus** O: caudal lateral epicondyle I: lateral olecranon		**anconeus** O: caudal lateral epicondyle I: lateral olecranon	**anconeus** O: caudal lateral epicondyle I: lateral olecranon	**anconeus** O: caudal lateral epicondyle I: lateral olecranon	**anconeus** O: lateral epicondule I: lateral olecranon
BRACHIORADIALIS		**brachioradialis** absent		**brachioradialis** absent	**brachioradialis** absent	**brachioradialis** absent	**brachioradialis** absent
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis longus** O: lateral supracondylar ridge H I: base MC2	**ext carpi radialis longus** O: lateral supracondylar ridge I: middle MC2	**ext carpi radialis longus** O: lateral supracondylar ridge I: middle MC2	**ext carpi radialis longus** O: lateral supracondylar ridge I: middle MC2	**ext carpi radialis longus** O: lateral supracondylar ridge I: middle MC2	**ext carpi radialis longus** O: lateral supracondylar ridge I: middle MC2	**ext carpi radialis longus** O: lateral epicondyle I: distal MC2
EXT CARPI RADIALIS, brevis (MC3)	**ext carpi radialis brevis** O: lateral supracondylar ridge H I: base MC3	**ext carpi radialis brevis** O: lateral epicondyle I: middle MC3	**ext carpi radialis brevis** O: lateral epicondyle I: middle MC3	**ext carpi radialis brevis** O: lateral epicondyle I: middle MC3	**ext carpi radialis brevis** O: lateral epicondyle I: middle MC3	**ext carpi radialis brevis** O: lateral epicondyle I: middle MC3	**ext carpi radialis brevis** O: lateral epicondyle I: distal MC3
EXT DIGITORUM COMMUNIS	**ext digitorum communis** O: lateral supracondylar ridge H I: digits 2, 3, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral supracondylar ridge I: digits 2, 3, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5

	Myomorpha continued						
	Cricetidae						**Muridae**
	Myodes **Stein, 1986**	***Neotoma*** **Rinker, 1954**	***Ondatra*** **Kesner, 1986**	***Oryzomys*** **Rinker, 1954**	***Peromyscus*** **Rinker, 1954**	***Sigmodon*** **Rinker, 1954**	***Rattus*** **Greene, 1935**
EXT DIGITORUM LATERALIS	**ext digiti quinti proprius** O: lateral supracondylar ridge H I: digits 4, 5	**ext digiti quinti proprius** O: lateral epicondyle I: digits 4, 5	**ext digiti quinti proprius** O: lateral epicondyle I: digits 4, 5	**ext digiti quinti proprius** O: lateral epicondyle I: digits 4, 5	**ext digiti quinti proprius** O: lateral epicondyle I: digits 4, 5	**ext digiti quinti proprius** O: lateral epicondyle I: digits 4, 5	**ext digiti quarti + ext digiti quinti proprius** O: lateral epicondyle I: digits 4, 5 * 2 heads
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle + U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5
SUPINATOR	**supinator** O: lateral epicondyle I: proximal cranio-lateral R	**supinator** O: sesamoid at annular ligament R I: proximal cranio-lateral R	**supinator** O: lateral epicondyle + sesamoid at radial collateral ligament I: proximal 1/3 R	**supinator** O: sesamoid at lateral epicondyle I: proximal cranio-lateral R	**supinator** O: sesamoid at annular ligament R I: proximal cranio-lateral R	**supinator** O: lateral epicondyle I: proximal cranio-lateral R	**supinator** O: lateral epicondyle I: medial R
ABD POLLICIS LONGUS	**abd pollicis longus** O: lateral U + R I: base MC1, falciform	**abd pollicis longus** O: R + U I: MC1 + falciform	**abd pollicis longus** O: R + U I: MC1 + falciform	**abd pollicis longus** O: R + U I: MC1 + falciform	**abd pollicis longus** O: R + U I: MC1 + falciform	**abd pollicis longus** O: R + U I: MC1 + falciform	**ext pollicis brevis or abd pollicis longus** O: R I: digit 1
EXT DIGITORUM PROFUNDUS	**ext indicis** O: lateral U + R I: digit 2	**ext indicis** O: middle lateral U I: digits 1, 2	**ext indicis** O: middle lateral U I: digits 1, 2	**ext indicis** O: middle lateral U I: digit 2	**ext indicis** O: middle lateral U I: digits 1, 2	**ext indicis** O: middle lateral U I: digit 2	**ext indicis proprius** O: U I: digits 2, 3
EXT BREVIS DIGITORUM							
EXT POLLICIS LONGUS		**ext pollicis brevis** O: distal U I: falciform		**ext pollicis brevis** O: distal U I: falciform	**ext pollicis brevis** O: distal U I: falciform	**ext pollicis brevis** O: distal U I: falciform	**ext pollicis longus** O: U I: digit 1
EXT POLLICIS BREVIS	**ext pollicis brevis** absent						
PRONATOR TERES	**pronator teres** O: medial epicondyle I: middle R	**pronator teres** O: medial epicondyle I: middle 1/2 R	**pronator teres** O: medial epicondyle I: middle 1/2 R	**pronator teres** O: medial epicondyle I: middle 1/4 R	**pronator teres** O: medial epicondyle I: middle R	**pronator teres** O: medial epicondyle I: middle 1/3 R	**pronator teres** O: medial epicondyle I: middle medial R

	Myomorpha continued						
	Cricetidae						Muridae
	Myodes **Stein, 1986**	***Neotoma*** **Rinker, 1954**	***Ondatra*** **Kesner, 1986**	***Oryzomys*** **Rinker, 1954**	***Peromyscus*** **Rinker, 1954**	***Sigmodon*** **Rinker, 1954**	***Rattus*** **Greene, 1935**
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: base MC3	**flx carpi ulnaris** O: medial epicondyle I: base MC3	**flx carpi radialis** O: medial epicondyle I: base MC3	**flx carpi ulnaris** O: medial epicondyle I: base MC3	**flx carpi ulnaris** O: medial epicondyle I: base MC3	**flx carpi ulnaris** O: medial epicondyle I: base MC3	**flx carpi radialis** O: medial epicondyle I: proximal MC3
PALMARIS LONGUS	**palmaris longus** O: medial epicondyle I: palmar fascia	**palmaris longus** O: medial epicondyle I: falciform + thenar + hypothenar pads	**palmaris longus** O: medial epicondyle I: falciform + thenar + hypothenar pads	**palmaris longus** O: medial epicondyle I: falciform + thenar + hypothenar pads	**palmaris longus** O: medial epicondyle I: falciform + thenar + hypothenar pads	**palmaris longus** O: medial epicondyle I: falciform + thenar + hypothenar pads	**palmaris longus** O: medial epicondyle I: palmar fascia
FLX DIGITORUM SUPERFICIALIS	**flx digitorum sublimis** O: distal medial epicondyle I: digits 2, 3f, 4f	**flx digitorum sublimis** O: medial epicondyle I: digits 2, 3, 4	**flx digitorum sublimis** O: medial epicondyle I: digits 2, 3f, 4f	**flx digitorum sublimis** O: medial epicondyle I: digits 2, 3, 4	**flx digitorum sublimis** O: medial epicondyle I: digits 2, 3, 4	**flx digitorum sublimis** O: medial epicondyle I: digits 2, 3, 4	**flx digitorum sublimis (m)** O: medial epicondyle I: digits 2f, 3f, 4f, 5f
INTERFLEXORII							
FLX DIGITORUM PROFUNDUS, **epicondylar** **epicondylar (FDPe)** **epicondylar (FDPd)** **ulnar** **radial**	**flx digitorum profundus** O: medial epicondyle O: medial epicondyle O: medial 2/3 R + middle U *I: digits 1, 2, 3, 4, 5	**flx digitorum profundus** O: medial epicondyle O: medial epicondyle O: U + R *I: digits 1, 2, 3, 4, 5	**flx digitorum profundus** O: medial epicondyle O: medial epicondyle O: U + R *I: digits 1, 2, 3, 4, 5	**flx digitorum profundus** O: medial epicondyle O: medial epicondyle O: U + R *I: digits 1, 2, 3, 4, 5	**flx digitorum profundus** O: medial epicondyle O: medial epicondyle O: U + R *I: digits 1, 2, 3, 4, 5	**flx digitorum profundus** O: medial epicondyle O: medial epicondyle O: U + R *I: digits 1, 2, 3, 4, 5	**flx digitorum profundus** O: medial epicondyle O: medial epicondyle O: U O: R *I: digits 2, 3, 4, 5
LUMBRICALES	**lumbricales** O: FDP I: digits 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5	
FLX CARPI ULNARIS, epitrochlear belly **ulnar belly**	**flx carpi ulnaris** O: caudo-medial olecranon I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform	**flx carpi ulnaris** O: olecranon I: pisiform	**flx carpi ulnaris** O: olecranon I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform	**flx carpi ulnaris** O: medial epicondyle O: olecranon I: pisiform
EPITROCHLEO-ANCONEUS	**epitrochleoanconeus** O: medial epicondyle I: medial olecranon	**epitrochleoanconeus** O: medial epicondyle I: medial olecranon	**epitrochleoanconeus** O: medial epicondyle I: medial olecranon	**epitrochleoanconeus** O: medial epicondyle I: medial olecranon	**epitrochleoanconeus** O: medial epicondyle I: medial olecranon	**epitrochleoanconeus** O: medial epicondyle I: medial olecranon	

	Myomorpha continued						
	Cricetidae						Muridae
	Myodes **Stein, 1986**	***Neotoma*** **Rinker, 1954**	***Ondatra*** **Kesner, 1986**	***Oryzomys*** **Rinker, 1954**	***Peromyscus*** **Rinker, 1954**	***Sigmodon*** **Rinker, 1954**	***Rattus*** **Greene, 1935**
PRONATOR QUADRATUS	**pronator quadratus** O: middle 1/3 U + R	**pronator quadratus** O: distal 3/5 U + R	**pronator quadratus** O: distal U + R	**pronator quadratus** O: distal 3/5 U + R	**pronator quadratus** O: distal 3/5 U + R	**pronator quadratus** O: distal 3/5 U + R	**pronator quadratus** O: distal 1/4 U + R
PALMARIS BREVIS	**palmaris brevis** absent	**palmaris brevis** O: falciform I: hypothenar pad	**palmaris brevis** hypothenar + thenar pads	**palmaris brevis** O: falciform I: hypothenar pad	**palmaris brevis** O: falciform I: hypothenar pad	**palmaris brevis** O: falciform I: hypothenar pad	
FLX DIGITORUM BREVIS MANUS	**abd digiti quinti** O: palmar fascia I: fascia base digit 5	**abd digiti quinti** O: base hypothenar pad (PL) I: fascia digit 5	**abd digiti quinti** absent	**abd digiti quinti** O: base hypothenar pad (PL) I: fascia digit 5	**abd digiti quinti** O: base hypothenar pad (PL) I: fascia digit 5	**abd digiti quinti** O: base hypothenar pad (PL) I: fascia digit 5	
ABD DIGITI MINIMI	**opponens digiti quinti** O: pisiform I: digit 5	**opp digiti quinti** O: pisiform I: sesamoid at digit 5	**opp digiti quinti** O: pisiform I: digit 5	**opp digiti quinti** O: pisiform I: sesamoid at digit 5	**opp digiti quinti** O: pisiform I: sesamoid at digit 5	**opp digiti quinti** O: pisiform I: sesamoids at digit 5	**abd digiti quinti** O: pisiform I: digit 5
ABD POLLICIS BREVIS	**abd pollicis brevis** O: falciform I: MC1	**abd pollicis brevis** O: falciform I: MC1	**abd pollicis brevis** absent	**abd pollicis brevis** O: falciform I: MC1	**abd pollicis brevis** O: falciform I: MC1	**abd pollicis brevis** O: falciform I: MC1	**abd pollicis (r)** O: falciform I: digit 1
CONTRAHENTES	**add pollicis, add digiti secundi, add digiti quinti** O: deep palmar ligament I: digits 1L, 2L, 5M	**add pollicis, add digiti secundi, add digiti quinti** O: MC2, between digits 3+4 I: digit 1L, 2L, 5M	**add pollicis, add digiti secundi, add digiti quinti** I: digit 1L, 2L, 5M	**add pollicis, add digiti secundi, add digiti quinti** O: MC2, between digits 3+4 I: digit 1L, 2L, 5M	**add pollicis, add digiti secundi, add digiti quinti** O: MC2, between digits 3+4 I: digit 1L, 2L, 5M	**add pollicis, add digiti secundi, add digiti quinti** O: MC2, between digits 3+4 I: digit 1L, 2L, 5M	**add pollicis** O: carpals + MC2-3 I: digit 1L
FLEXOR BREVES PROFUNDUS	**flx pollicis brevis, flx digiti quinti brevis, interossei** 9	**flx pollicis brevis, flx digiti quinti brevis, interossei** 9	**flx pollicis brevis, flx digiti quinti brevis, interossei** 7	**flx pollicis brevis, flx digiti quinti brevis, interossei** 9	**flx pollicis brevis, flx digiti quinti brevis, interossei** 9	**flx pollicis brevis, flx digiti quinti brevis, interossei** 9	**interossei, flx pollicis brevis, flx digiti quinti brevis** 8
INTERMETACARPALES							
? Unknown homology							**opp digiti quinti** O: pisiform I: MC5
? Unknown homology							
RADIAL SESAMOID "PRE-POLLUX"							present
ULNAR SESAMOID							
CARPAL VIBRISSAE							

	SCANDENTIA								DERMOPTERA
	Tupaiidae						Ptilocercidae		Cynocephalidae
	Dendrogale Davis, 1938	*Dendrogale* Endo et al., 1999	*Tupaia* Haines, 1955	*Tupaia* Le Gros Clark, 1924	*Tupaia* Straus, 1942	*Urogale* George, 1977	*Ptilocercus* Haines, 1955	*Ptilocercus* Le Gros Clark, 1926	*Cynocephalus* Diogo, 2009
PANNICULUS CARNOSUS		**cutaneus trunci**		**dorso-humeralis** O: back + sides I: proximal lateral H		**panniculus carnosus** O: trunk I: medial deltoid tuberosity H w/ PA		**dorso-humeralis** O: abdomen I: H w/ PA	
STERNO-FACIALIS									
STERNOMASTOIDEUS				**sterno-mastoid**				**sternomastoid** O: mastoid I: manubrium	**sternomastoideus** O: mastoid I: sternum + opposite partner
CLEIDOMASTOIDEUS				**cleido-mastoid**				**sternomastoid - clavicular part** O: occipital crest + mastoid I: medial clavicle	**cleidomastoideus** O: mastoid I: sternum
CLAVOTRAPEZIUS				**cleido-occipital** O: occipital crest I: medial clavicle					**cleido-occipitalis** absent
CEPHALOHUMERALIS									
ACROMIOTRAPEZIUS	**trapezius, acromial part** O: ?-T2 I: metacromion + spine scapula	**trapezius**		**trapezius** O: occiput, ligamentum nuchae, all T vertebrae I: spine scapula		**trapezius** O: occiput, ligamentum nuchae, T1-13 I: spine scapula		**trapezius** O: occiput, ligamentum nuchae, T1-9 I: spine scapula	**acromiotrapezius** O: vertebrae I: acromion
DORSO-CUTANEUS									**dorso-cutaneous** absent
SPINOTRAPEZIUS	**trapezius , spinous part** O: T2-L2 I: spine scapula								**spinotrapezius** O: vertebrae I: spine scapula

	SCANDENTIA								DERMOPTERA
	Tupaiidae						Ptilocercidae		Cynocephalidae
	Dendrogale **Davis, 1938**	***Dendrogale*** **Endo et al., 1999**	***Tupaia*** **Haines, 1955**	***Tupaia*** **Le Gros Clark, 1924**	***Tupaia*** **Straus, 1942**	***Urogale*** **George, 1977**	***Ptilocercus*** **Haines, 1955**	***Ptilocercus*** **Le Gros Clark, 1926**	***Cynocephalus*** **Diogo, 2009**
RHOMBOIDEUS CAPITIS				**rhomboideus capitis** O: occipital crest, atlas I: spine scapula + vertebral border scapula		**rhomboideus** O: nuchal crest, ligamentum nuchae, T4-6 I: vertebral border scapula		**rhomboideus capitis** O: nuchal crest I: vertebral border scapula	
RHOMBOIDEUS CERVICIS		**r. cervicalis**							
RHOMBOIDEUS THORACIS		**r. thoracics**		**rhomboideus cervicis** O: T1-3 I: vertebral border scapula				**rhomboideus cervicis** O: T1-4 I: vertebral border scapula	
OMOTRANSVERSARIUS "metacromion"	**levator scapulae** O: atlas I: coracoid process			**levator scapulae** O: atlas I: acromion + spine scapula		**atlantoscapularis ventralis** O: atlas I: metacromion		**levator scapulae anticus** O: atlas I: metacromion	
OMOTRANSVERSARIUS						**atlantoscapularis dorsalis** O: atlas I: spine scapula, cranial angle + vertebral border scapula		**levator scapulae posticus** O: atlas I: vertebral border scapula	
OMOHYOIDEUS				**omohyoid** O: hyoid I: cranial border of scapula near coracoid		**omohyoideus** O: hyoid I: cranial border of scapula near coracoid		**omohyoid** O: basihyal I: cranial border of scapula near coracoid	**omohyoideus** absent
SERRATUS VENTRALIS CERVICIS								**levator anguli scapulae** O: C2-7 I: vertebral border scapula w/ SVT	
SERRATUS VENTRALIS THORACIS	**serratus anticus** O: C4-7, ribs 1-8 I: caudal angle + vertebral border scapula					**serratus magnus** O: C2-7, ribs 4-9 I: deep surface vertebral border scapula			

	SCANDENTIA								DERMOPTERA
	Tupaiidae						Ptilocercidae		Cynocephalidae
	Dendrogale **Davis, 1938**	***Dendrogale*** **Endo et al., 1999**	***Tupaia*** **Haines, 1955**	***Tupaia*** **Le Gros Clark, 1924**	***Tupaia*** **Straus, 1942**	***Urogale*** **George, 1977**	***Ptilocercus*** **Haines, 1955**	***Ptilocercus*** **Le Gros Clark, 1926**	***Cynocephalus*** **Diogo, 2009**
CLAVODELTOIDEUS	**deltoideus** O: clavicle I: deltoid crest H w/ AD	**deltoideus** O: "ventral space"				**deltoideus pars claviculodeltoideus** O: clavicle I: middle deltoid tuberosity H		**deltoid, clavicular head** O: clavicle I: deltoid crest H w/ AD	
ACROMIODELTOIDEUS	**deltoideus** O: acromion I: deltoid crest H w/ CD	**deltoideus** O: acromion		**deltoideus** O: acromion + lateral clavicle I: deltoid tuberosity H		**deltoideus pars acromiodeltoideus** O: acromion I: middle deltoid tuberosity H		**deltoid, acromial head** O: acromion I: deltoid crest H w/ CD	
SPINODELTOIDEUS	**teres minor** O: fascia IN I: H near IN	**deltoideus** O: spine scapula		**teres minor** O: spine scapula I: H		**deltoideus pars spinodeltoideus** O: spine scapula I: middle deltoid tuberosity H		**teres minor** O: spine scapula I: H	
TERES MINOR	**deltoideus, spinal division** absent								
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT			**subscapularis** O: subscapular fossa I: LT		**subscapularis** O: subscapular fossa I: LT		**subscapularis (divided)** O: subscapular fossa I: LT	
TERES MAJOR	**teres major** O: caudal angle + border scapula I: LT	**teres major** O: caudal scapula		**teres major** O: caudal angle + border scapula I: medial bicipital groove H		**teres major** O: caudal angle + border scapula I: medial intertubercular groove H		**teres major** O: caudal angle + border scapula I: medial bicipital groove H	

	SCANDENTIA								DERMOPTERA
	Tupaiidae						Ptilocercidae		Cynocephalidae
	Dendrogale **Davis, 1938**	***Dendrogale*** **Endo et al., 1999**	***Tupaia*** **Haines, 1955**	***Tupaia*** **Le Gros Clark, 1924**	***Tupaia*** **Straus, 1942**	***Urogale*** **George, 1977**	***Ptilocercus*** **Haines, 1955**	***Ptilocercus*** **Le Gros Clark, 1926**	***Cynocephalus*** **Diogo, 2009**
LATISSIMUS DORSI "superficial" "deep"	**latissimus dorsi** O: dorsal midline I: bicipital groove H I: "as in *Tupaia*"	**latissimus dorsi** O: thorax I: ? caudo-medial scapula		**latissimus dorsi + spino-humeralis** O: T5-13, lumbar aponeurosis // T2-6 I: bicipital groove H I: H w/ TMA		**latissimus dorsi + spino-humeralis** O: T6-13, lumbar aponeurosis I: intertubercular groove H I: TMA		**latissimus dorsi** O: T5-13, lumbodorsal aponeurosis, ribs 11-14 I: bicipital groove H	
DORSO-EPITROCHLEARIS	**dorso-epitrochlearis** O: LD + TMA (2 heads) I: olecranon	**triceps brachii, long head, dorsal bundle** O: IN I: ? tibia		**dorso-epitrochlearis** O: LD + TMA (2 heads) I: olecranon		**dorso-epitrochlearis** O: LD + TMA I: olecranon		**dorso-epitrochlearis** O: LD + TMA (2 heads) I: medial olecranon	
PECTORALIS SUPERFICIALIS "clavicular"									
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis major** I: bicipital groove H	**pectoralis superficialis (1)** O: sternum I: H		**pectoralis major** O: sternum + xiphisternum I: lateral bicipital groove H		**pectoralis major** O: manubrium, sterum I: medial deltoid tuberosity H		**pectoralis major** O: medial clavicle, manubrium, sternum, rectus sheath I: lateral bicipital groove H	
PECTORALIS SUPERFICIALIS "deep"		**pectoralis superficialis (2)** O: sternum I: H							
PECTORALIS PROFUNDUS	**pectoralis minor** O: ribs 4-6 I: GHj capsule	**pectoralis superficialis (3)** O: sternum I: H		**pectoralis minor** O: ribs 2-6 I: GHj capsule		**pectoralis minor** O: ribs 2-7 I: GHj capsule		**pectoralis minor** O: sternum, ribs 4-7 I: GHj capsule, GT, lateral bicipital groove H, fascia biceps	
PECTORALIS ABDOMINALIS	**pectoralis abdominis** O: xiphisternum I: GHj capsule			**abdomino-humeralis** O: distal PS I: GHj capsule w/ PP		**pectoralis abdominalis** O: linea alba I: medial deltoid tuberosity H		**abdomino-humeralis** O: rectus sheath I: neck H w/ PC	

	SCANDENTIA								DERMOPTERA
	Tupaiidae						Ptilocercidae		Cynocephalidae
	Dendrogale **Davis, 1938**	***Dendrogale*** **Endo et al., 1999**	***Tupaia*** **Haines, 1955**	***Tupaia*** **Le Gros Clark, 1924**	***Tupaia*** **Straus, 1942**	***Urogale*** **George, 1977**	***Ptilocercus*** **Haines, 1955**	***Ptilocercus*** **Le Gros Clark, 1926**	***Cynocephalus*** **Diogo, 2009**
SUBCLAVIUS	**subclavius** O: rib 1 I: lateral clavicle			**subclavius** O: rib 1 I: lateral clavicle		**subclavius** O: sternoclavicular joint I: clavicle		**subclavius** O: rib 1 I: lateral clavicle	
STERNOSCAPULARIS									
CORACOBRACHIALIS	**coracobrachialis, long head** O: coracoid I: medial bicipital groove H			**coraco-brachialis pars brevis** O: coracoid I: medial bicipital groove H		**coracobrachialis profundus** O: coracoid O: neck H distal to LT		**coraco-brachialis short head** O: coracoid I: medial bicipital groove H	
CORACOBRACHIALIS	**coracobrachialis, short head** O: coracoid I: medial H, medial epicondyle			**coraco-brachialis pars longa** O: coracoid I: middle medial H, medial epicondyle		**coracobrachialis proprius** O: coracoid I: distal cranio-medial H to medial supracondylar ridge		**coraco-brachialis long head** O: coracoid I: middle medial H, medial epicondyle	
BICEPS BRACHII, short head				**biceps, short + long heads** O: coracoid + supraglenoid tubercle I: R tubercle		**biceps brachii** O: coracoid + glenoid I: R tuberosity		**biceps** O: coracoid w/ CB + glenoid I: R tuberosity	
BICEPS BRACHII, long head	**biceps** O: supraglenoid tubercle I: R tubercle								
BRACHIALIS	**brachialis anticus medial + lateral heads** O: cranial H // lateral H I: coronoid process U	**brachialis** O: caudo-lateral H I: cranio-lateral R		**brachialis anticus, medial + lateral** O: lateral + medial H I: coronoid process U		**brachialis** O: lateral H I: coronoid process U		**brachialis anticus** O: distal cranial H I: coronoid process U	
CUBITALIS									
SUPRASPINATUS	**supraspinatus (divided)** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: cranial H		**supraspinatus** O: supraspinous fossa I: GT		**supraspinatus** O: supraspinous fossa I: GT		**supraspinatus** O: supraspinous fossa I: GT	

	SCANDENTIA								DERMOPTERA
	Tupaiidae						Ptilocercidae		Cynocephalidae
	Dendrogale **Davis, 1938**	***Dendrogale*** **Endo et al., 1999**	***Tupaia*** **Haines, 1955**	***Tupaia*** **Le Gros Clark, 1924**	***Tupaia*** **Straus, 1942**	***Urogale*** **George, 1977**	***Ptilocercus*** **Haines, 1955**	***Ptilocercus*** **Le Gros Clark, 1926**	***Cynocephalus*** **Diogo, 2009**
INFRASPINATUS	**infraspinatus** O: infraspinous fossa I: head H	**infraspinatus** O: infraspinous fossa I: LT		**infraspinatus** O: infraspinous fossa I: GT		**infraspinatus** O: infraspinous fossa I: GT		**infraspinatus** O: infraspinous fossa I: GT	
TRICEPS BRACHII CAPUT LATERALE	**triceps lateralis superficial head** O: GT I: lateral olecranon w/ A	**triceps brachii, lateral head** O: crest H I: R		**triceps, lateral head** O: neck H I: olecranon		**triceps brachii caput laterale** O: lateral deltoid tuberosity + caduo-medial neck H I: olecranon		**triceps, lateral head** O: caudal medial neck H I: lateral olecranon	
TRICEPS BRACHII CAPUT MEDIALE	**triceps medialis** O: medial H I: olecranon	**triceps brachii, medial head** O: medial space		**triceps, medial head** O: H		**triceps brachii caput mediale** O: caudo-medial H I: olecranon		**triceps, medial head** O: medial H I: olecranon	
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps longus** O: infraglenoid tubercle I: tip olecranon	**triceps brachii, long head, ventral bundle** O: caudal border scapula I: ? tibia		**triceps, long head** O: infraglenoid tubercle		**triceps brachii caput longum** O: caudal border scapula I: olecranon		**triceps, long head** O: infraglenoid ridge scapula I: tip olecranon	
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)									
TRICEPS BRACHII ACCESSORY	**triceps lateralis deep head** O: distal 1/2 H I: w/ TLA lateral olecranon	**triceps brachii, accessory head** O: crest H I: R		**triceps, lateral head** O: caudal H I: w/ TLA lateral olecranon				**triceps, lateral head** O: caudal H I: w/ TLA lateral olecranon	
ANCONEUS				**anconeus** w/ TME		**anconeus** w/ TME		**anconeus** w/ TME	
BRACHIORADIALIS			**brachioradialis** present	**brachioradialis** O: lateral supracondylar ridge H I: distal R		**brachioradialis** O: lateral supracondylar ridge H I: distal R	**brachioradialis** absent	**brachioradialis** absent	

	SCANDENTIA								**DERMOPTERA**
	Tupaiidae						**Ptilocercidae**		**Cynocephalidae**
	Dendrogale **Davis, 1938**	***Dendrogale*** **Endo et al., 1999**	***Tupaia*** **Haines, 1955**	***Tupaia*** **Le Gros Clark, 1924**	***Tupaia*** **Straus, 1942**	***Urogale*** **George, 1977**	***Ptilocercus*** **Haines, 1955**	***Ptilocercus*** **Le Gros Clark, 1926**	***Cynocephalus*** **Diogo, 2009**
EXT CARPI RADIALIS, longus (MC2)		**ext carpi radialis** O: lateral distal H I: "forepaw region"	**ext carpi radialis brevis** I: base MC2	**ext carpi radialis longus** O: lateral supracondylar ridge H I: base MC2		**ext carpi radialis brevis** O: lateral supracondylar ridge H I: base MC2	**ext carpi radialis brevis** I: base MC2	**ext carpi radialis and brevis** O: supinator ridge I: base MC2 + 3	
EXT CARPI RADIALIS, brevis (MC3)			**ext carpi radialis longus** I: base MC3	**ext carpi radialis brevis** O: lateral epicondyle I: base MC3		**ext carpi radialis longus** O: lateral supracondylar ridge H I: base MC3	**ext carpi radialis longus** I: base MC3		
EXT DIGITORUM COMMUNIS		**ext digitorum communis** O: lateral distal H I: "forepaw region"	**ext digitorum communis** I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 4, 5		**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 3, 4, 5	
EXT DIGITORUM LATERALIS		**ext digitorum lateralis** O: lateral distal H I: "forepaw region"	**ext digitorum ulnaris** I: digits 4, 5	**ext digitorum lateralis** O: lateral epicondyle w/ EDC I: digits 4, 5		**ext digitorum ulnaris** O: lateral epicondyle I: digits 4, 5	**ext digitorum ulnaris** I: digits 4, 5	**ext digitorum lateralis** O: EDC I: digits 4, 5	
EXT CARPI ULNARIS		**ext carpi ulnaris** O: lateral distal H I: "forepaw region"	**ext carpi ulnaris** I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5		**ext carpi ulnaris** O: lateral epicondyle I: MC5	**ext carpi ulnaris** I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	
SUPINATOR				**supinator** O: lateral epicondyle I: cranio-lateral R		**supinator** O: lateral epicondyle I: lateral R		**supinator** O: lateral epicondyle I: cranio-lateral R	
ABD POLLICIS LONGUS			**abd pollicis longus** I: base MC1	**abd pollicis** O: proximal R + U I: base MC1		**abd pollicis longus** O: proximal R + U I: trapezium, base MC1, radial sesamoid	**abd pollicis longus** I: base MC1	**abd pollicis longus** O: proximal R + U I: base MC1	

	SCANDENTIA								DERMOPTERA
	Tupaiidae						**Ptilocercidae**		**Cynocephalidae**
	Dendrogale **Davis, 1938**	***Dendrogale*** **Endo et al., 1999**	***Tupaia*** **Haines, 1955**	***Tupaia*** **Le Gros Clark, 1924**	***Tupaia*** **Straus, 1942**	***Urogale*** **George, 1977**	***Ptilocercus*** **Haines, 1955**	***Ptilocercus*** **Le Gros Clark, 1926**	***Cynocephalus*** **Diogo, 2009**
EXT DIGITORUM PROFUNDUS			**ext digitorum profundus** I: digits 2, 3	**ext profundus** O: caudo-lateral U I: digits 1, 2, 3, (4)		**ext digitorum radialis** O: lateral U I: digits 1, 2, 3	**ext digitorum profundus** I: digits 2, 3	**ext digitorum profundus** O: lateral U I: digits 2, 3	
EXT POLLICIS LONGUS			**ext pollicis longus** - I: digit 1				**ext pollicis longus** I: digit 1	**ext pollicis longus** O: lateral olecranon I: digit 1	
EXT POLLICIS BREVIS						**ext pollicis brevis** absent		**ext pollicis brevis** absent	
EXT BREVIS DIGITORUM									
PRONATOR TERES		**pronator teres** O: medial epicondyle	**pronator teres** O: medial epicondyle	**pronator radii teres** O: medial epicondyle I: middle lateral R		**pronator teres** O: medial epicondyle I: middle R		**pronator radii teres** O: medial epicondyle I: middle lateral R	
FLX CARPI RADIALIS		**flx carpi radialis**	**flx carpi radialis** O: medial epicondyle I: MC2 + 3	**flx carpi radialis**	**flx carpi radialis**	**flx carpi radialis** O: medial epicondyle I: base MC2 + 3		**flx carpi radialis** O: medial epicondyle I: base MC2	
PALMARIS LONGUS			**palmaris longus** O: medial epicondyle I: palmar aponeurosis	**palmaris longus** O: medial epicondyle I: palmar fascia	**palmaris longus** O: medial epicondyle I: palmar aponeurosis	**palmaris longus** O: medial epicondyle I: palmar aponeurosis	**palmaris longus**	**palmaris longus** O: medial epicondyle I: transverse carpal ligament	
FLX DIGITORUM SUPERFICIALIS		**flx digitorum superficialis** O: medial distal H I: digits	**flx digitorum sublimis** O: FDPe	**flx sublimis digitorum** O: medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum superficialis** O: medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum superficialis** O: medial epicondyle I: digits 2f, 3f, 4f	**flx digitorum sublimis** I: digits 2, 3, 4, 5	**flx sublimis digitorum** O: medial epicondyle I: digits 2f, 3f, 4f, 5f	
INTERFLEXORII				**FDS-FDP**	(see condylo-ulnaris)	**FDS-FDP**		**FDS-FDP**	

	SCANDENTIA								DERMOPTERA
	Tupaiidae						Ptilocercidae		Cynocephalidae
	Dendrogale	*Dendrogale*	*Tupaia*	*Tupaia*	*Tupaia*	*Urogale*	*Ptilocercus*	*Ptilocercus*	*Cynocephalus*
	Davis, 1938	**Endo et al., 1999**	**Haines, 1955**	**Le Gros Clark, 1924**	**Straus, 1942**	**George, 1977**	**Haines, 1955**	**Le Gros Clark, 1926**	**Diogo, 2009**
FLX DIGITORUM PROFUNDUS,		**flx digitorum profundus**	**flx digitorum profundus, condylo-radialis**	**flx profundus digitorum**	**flx digitorum profundus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx profundus digitorum (m + u)**	
epicondylar			O: medial epicondyle (m)		O: medial epicondyle				
epicondylar (FDPe)			O: medial epicondyle (u)	O: medial epicondyle	O: medial epicondyle	O: medial epicondyle		O: medial epicondyle	
epicondylar (FDPd)				O: interosseus membrane + R + U	O: deep surface FDS	O: medial epicondyle			
ulnar		O: proximal R + U		O: medial U		O: medial olecranon + U		O: cranio-medial U + interosseus membrane	
radial		O: proximal R + U		O: R		O: R *I: digits 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	O: R *I: digits 1, 2, 3, 4, 5	
LUMBRICALES			**lumbricals** 4	**lumbricales** O: FDP I: digits 2, 3, 4, 5		**lumbricales manus - 4** O: FDP I: digits 2, 3, 4, 5	**lumbricals** 4	**lumbricales** O: FDP I: digits 2, 3, 4, 5	
FLX CARPI ULNARIS,		**flx carpi ulnaris**	**flx carpi ulnaris**	**flx carpi ulnaris**		**flx carpi ulnaris**		**flx carpi ulnaris**	
epitrochlear belly		O: ? lateral epicondyle		O: medial epicondyle		O: medial epicondyle		O: medial epicondyle	
ulnar belly				O: medial olecranon I: pisiform		O: medial olecranon I: pisiform + MC5		O: medial olecranon I: pisiform + MC5	
EPITROCHLEO-ANCONEUS	**anconeus** O: medial epicondyle I: olecranon		**epitrochleo-anconeus** O: medial epicondyle I: medial olecranon	**condylo-olecranon** O: medial supracondylar ridge I: olecranon		**epitrochleo-anconeus** O: caudal medial epicondyle I: medial olecranon	**epitrochleo-anconeus** present	**condylo-olecranonis** O: medial supracondylar ridge I: olecranon	
PRONATOR QUADRATUS			**pronator quadratus** "well developed"	**pronator quadratus** O: distal 1/4 R + U	**pronator quadratus** O: distal 1/5 U + R	**pronator quadratus** O: distal 1/5 U + R		**pronator quadratus** O: distal R + U	

	SCANDENTIA								DERMOPTERA
	Tupaiidae						Ptilocercidae		Cynocephalidae
	Dendrogale **Davis, 1938**	***Dendrogale*** **Endo et al., 1999**	***Tupaia*** **Haines, 1955**	***Tupaia*** **Le Gros Clark, 1924**	***Tupaia*** **Straus, 1942**	***Urogale*** **George, 1977**	***Ptilocercus*** **Haines, 1955**	***Ptilocercus*** **Le Gros Clark, 1926**	***Cynocephalus*** **Diogo, 2009**
PALMARIS BREVIS				**palmaris brevis** I: hypothenar eminence		**palmaris brevis** O: palmar aponeurosis I: hypothenar fascia		**palmaris brevis** O: transverse carpal ligament I: skin ulnar side palm	
FLX DIGITORUM BREVIS MANUS				**flx brevis manus** O: annular ligmaent I: digit 5f		**flx brevis manus** O: pisiform + flx retinaculum I: digit 5	**flx brevis digitorum manus** O: palmar aponeurosis I: FDS digit 5	**flx brevis manus** O: transverse carpal ligament I: FDS digit 5	
ABD DIGITI MINIMI				**abd minimi digiti** O: pisiform I: digit 5		**abd digiti quinti manus** O: pisiform I: digit 5	**abd digiti quinti**	**abd minimi digiti** O: pisiform I: digit 5	
ABD POLLICIS BREVIS				**abd pollicis brevis** O: scaphoid, trapezium, MC1 I: digit 1		**abd pollicis brevis** O: flx retinaculum I: digit 1	**abd pollicis brevis**	**abd pollicis brevis** O: transverse carpal ligament + trapezoid I: digit 1 (sesamoid)	
CONTRAHENTES			**contrahentes** O: carpus + palm I: dig 1, 2, 5	**add pollicis** O: base MC2 + 3 I: digit 1L		**contrahentes manus - 3** O: ligaments carpometacarp. I: digits 1L, 2L, 5M	**contrahentes (u)** O: carpus I: dig 1, 2, 5	**contrahentes** O: carpus I: digits 1L, 2L, 5M	
FLEXOR BREVES PROFUNDUS			**flx breves profundus** 10	**flx brevis pollicis, flx brevis minimi digiti, palmar and dorsal interossei** 9		**flx pollicis brevis + flx digiti quinti manus + interossei manus** 9	**flx breves profundus** 10	**flx brevis pollicis, flx brevis minimi digiti, flx breves digitorum** 10	
INTERMETACARPALES			**dorsal interossei**					**interossei** absent	
? Unknown homology				**opp pollicis** absent				**opp pollicis** absent	
? Unknown homology				**opponens** absent				**opp minimi digiti** absent	
RADIAL SESAMOID "PRE-POLLUX"							articulates w/ scaphoid	present	
ULNAR SESAMOID							at base MC5		
CARPAL VIBRISSAE									

	Strepsirhini						Tarsiiformes
	Daubentoniidae		Lemuridae			Galagidae	Tarsiidae
	Daubentonia **Owen, 1866**	***Daubentonia*** **Soligo, 2005**	***Hapalemur*** **Beddard, 1891**	***Lemur*** **Murie & Mivart, 1872**	***Lemur*** **Soligo, 2005**	***Otolemur*** **Murie & Mivart, 1872**	***Tarsius*** **Woollard, 1925**
PANNICULUS CARNOSUS							
STERNO-FACIALIS							
STERNOMASTOIDEUS	**sterno-cleido-mastoideus, sternal portion** O: mastoid I: manubrium			**sterno-cleido-mastoid** O: behind EAM I: manubrium + medial clavicle		**sterno-cleido-mastoid** O: behind EAM I: manubrium + medial clavicle	**sterno-mastoideus** O: mastoid I: sternum
CLEIDOMASTOIDEUS	**sterno-cleido-mastoideus, cleidal portion** O: mastoid I: medial clavicle						**cleido-occipitalis** O: occiput I: clavicle
CLAVOTRAPEZIUS							
CEPHALOHUMERALIS							
ACROMIOTRAPEZIUS	**trapezius** "large and strong" superficial to OT	**trapezius** O: occiput, ligamentum nucahe, T1-8 I: acromion + spine scapula superficial to OT	**trapezius** O: C vertebrae I: spine scapula	**trapezius** O: ligamentum nucahe, T1-9 I: spine scapula	**trapezius** O: ligamentum nucahe, T1-8 I: acromion + spine scapula deep to OT	**trapezius** O: ligamentum nucahe, T1-11 I: spine scapula	**trapezius** O: ligamentum nuchae, T1-4 I: spine scapula
DORSO-CUTANEUS				**depressor scapulae** absent		**depressor scapulae** absent	**depressor scapulae** O: T8-10 I: cranial angle scapula
SPINOTRAPEZIUS							

	Strepsirhini						Tarsiiformes
	Daubentoniidae		**Lemuridae**			**Galagidae**	**Tarsiidae**
	Daubentonia **Owen, 1866**	***Daubentonia*** **Soligo, 2005**	***Hapalemur*** **Beddard, 1891**	***Lemur*** **Murie & Mivart, 1872**	***Lemur*** **Soligo, 2005**	***Otolemur*** **Murie & Mivart, 1872**	***Tarsius*** **Woollard, 1925**
RHOMBOIDEUS CAPITIS		**rhomboideus capitis** I: cranial angle scapula		**r. capitis** O: occiput I: cranial angle scapula		**r. capitis** w/ RC+RT	**r. capitis** O: C1-2, ligamentum nuchae I: cranial angle scapula
RHOMBOIDEUS CERVICIS		**rhomboideus** O: C2-T3 I: vertebral border scapula	**rhomboideus** "single"	**rhomboideus** O: C6-T4 I: vertebral border scapula	**rhomboideus** O: C6-T4 I: cranial border scapula	**rhomboideus** O: C3-T4 I: vertebral border scapula	**rhomboideus** O: ligamentum nuchae, T1-3 I: vertebral border scapula
RHOMBOIDEUS THORACIS							
OMOTRANSVERSARIUS "metacromion"		**atlantoscapularis anterior** I: acromion + spine scapula	**levator claviculae** I: clavicle	**levator claviculae** O: atlas I: metacromion	**atlantoscapularis anterior** I: acromion + spine scapula	**levator claviculae** O: atlas I: metacromion	**levator scapulae anticus** O: atlas I: acromion
OMOTRANSVERSARIUS							
OMOHYOIDEUS	**omo-hyoideus** O: hyoid I: cranial border scapula			**omo-hyoid** O: hyoid I: cranial border scapula	**omohyoid** I: cranial angle scapula	**omo-hyoid** O: hyoid I: cranial border scapula	**omohyoid** O: hyoid I: cranial border scapula
SERRATUS VENTRALIS CERVICIS	**levatores** "large and strong"	**levator scapulae** O: C3-7 I: cranial angle scapula		**levator anguli scapulae** O: C1-7 I: vertebral border scapula	**levator scapulae** I: cranial angle scapula	**levator anguli scapulae** O: C1-7 I: vertebral border scapula	**levator angulae scapulae** O: C1-5 I: cranial angle scapula

	Strepsirhini						Tarsiiformes
	Daubentoniidae		Lemuridae			Galagidae	Tarsiidae
	Daubentonia **Owen, 1866**	***Daubentonia*** **Soligo, 2005**	***Hapalemur*** **Beddard, 1891**	***Lemur*** **Murie & Mivart, 1872**	***Lemur*** **Soligo, 2005**	***Otolemur*** **Murie & Mivart, 1872**	***Tarsius*** **Woollard, 1925**
SERRATUS VENTRALIS THORACIS		**serratus anterior** O: ribs 1-8 I: vertebral border scapula	**serratus magnus** O: ribs 1-8 I: vertebral border scapula	**serratus magnus** O: ribs 1-8 I: vertebral border scapula	**serratus anterior** I: vertebral border scapula	**serratus magnus** O: ribs 1-8 I: vertebral border scapula	**serratus anticus or magnus** O: ribs 2-9 I: vertebral border scapula
CLAVODELTOIDEUS		**deltoideus pars clavicularis** O: clavicle		**deltoid, first** O: middle clavicle I: w/ PSc + w/ AD		**deltoid, first** O: middle clavicle I: w/ PSc + w/ AD	**deltoid, first portion** O: lateral clavicle I: w/ PSc + w/ AD
ACROMIODELTOIDEUS	**deltoides** O: lateral clavicle, acromion, spine scapula I: proximal H	**deltoideus pars acromialis** O: acromion		**deltoid, second** O: acromion I: deltoid crest H w/ CD + SD	**deltoideus pars acromialis** O: acromion	**deltoid, second** O: acromion I: deltoid crest H w/ CD + SD	**deltoid, second portion** O: acromion I: distal lateral bicipital groove H w/ CD
SPINODELTOIDEUS		**deltoideus pars spinalis** O: spine scapula		**deltoid, third** O: spine scapula I: deltoid crest H w/ AD	**deltoideus pars spinalis** O: spine scapula	**deltoid, third** O: spine scapula I: deltoid crest H w/ AD	
TERES MINOR	**teres minor** O: beneath spine scapula I: GT	**teres minor** O: caudal border scapula I: GT	**teres minor** present	**teres minor** O: caudal border scapula I: ? radial tuberosity	**teres minor** O: caudal border scapula I: GT	**teres minor** O: caudal border scapula I: ? radial tuberosity	**teres minor** O: caudal border scapula I: GT
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT		**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT
TERES MAJOR	**teres major** O: caudal border scapula I: LT	**teres major** O: caudal angle + border scapula I: H	**teres major** "as usual"	**teres major** O: caudal border scapula I: medial bicipital groove H	**teres major** O: caudal border scapula I: H	**teres major** O: caudal border scapula I: medial bicipital groove H	**teres major** O: caudal border scapula I: medial bicipital groove H
LATISSIMUS DORSI "superficial" "deep"	**latissimus dorsi** O: ribs 8-12, thoracolumbar fascia I: proximal medial H	**latissimus dorsi** O: T3-12, lumbar fascia I: H I: w/ TMA	**latissimus dorsi** O: caudal T vertebrae I: w/ pectoralis	**latissimus dorsi** O: T6-12, lumbar fascia I: "as usual"	**latissimus dorsi** O: T5-12, lumbar fascia I: H	**latissimus dorsi** O: T6-12, lumbar fascia I: "as usual"	**latissimus dorsi** O: T6-12, L vertebrae + fascia I: bicipital groove H

	Strepsirhini						Tarsiiformes
	Daubentoniidae		Lemuridae			Galagidae	Tarsiidae
	Daubentonia **Owen, 1866**	***Daubentonia*** **Soligo, 2005**	***Hapalemur*** **Beddard, 1891**	***Lemur*** **Murie & Mivart, 1872**	***Lemur*** **Soligo, 2005**	***Otolemur*** **Murie & Mivart, 1872**	***Tarsius*** **Woollard, 1925**
DORSO-EPITROCHLEARIS	**accessory muscle of long portion of triceps** O: LD I: olecranon	**dorso-epitrochlearis** O: LD I: medial epicondyle + olecranon	**dorso-epitrochlear** O: LD I: U	**dorso-epitrochlear** O: LD I: medial epicondyle + olecranon	**dorso-epitrochlearis** O: LD I: medial epicondyle + olecranon	**dorso-epitrochlear** O: LD I: medial epicondyle + olecranon	**dorsi-epitrochlearis** O: LD I: olecranon w/ triceps
PECTORALIS SUPERFICIALIS "clavicular"							
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis major, upper** O: clavicle + manubrium I: distal pectoral ridge H		**pectoralis major, clavicular portion** O: sterno-clavicular joint	**pectoralis major, clavicular** O: sternoclavicular joint + medial clavicle I: lateral deltoid ridge H		**pectoralis major** O: sternum + clavicle I: bicipital groove H	**pectoralis major clavicular portoin** O: medial clavicle I: bicipital ridge H w/ PSs
PECTORALIS SUPERFICIALIS "deep"	**pectoralis major, lower** O: sternum, ribs 8-10 I: proximal pectoral ridge H		**pectoralis major, pectoral portion** O: sternum	**pectoralis major, sternal portion** O: sternum I: bicipital groove H			**pectoralis major second portion** O: sternum I: bicipital ridge H w/ PSc
PECTORALIS PROFUNDUS	**pectoralis minor** O: manubrium, ribs 1-5 I: GT		**pectoralis minor** absent	**pectoralis minor** O: sternum, ribs 2-6 I: GHj capsule		**pectoralis minor** O: sternum, ribs 2-6 I: GHj capsule	**pectoralis major third portion** O: ribs 5-8 I: lateral bicipital groove
PECTORALIS ABDOMINALIS				**pectoralis major, abdominal portion** O: rectus sheath I: w/ PSs			
SUBCLAVIUS			**subclavius** O: rib 1 I: clavicle	**subclavius** O: rib 1 I: lateral clavicle		**subclavius** O: rib 1 I: middle clavicle	**subclavius** O: rib 1 I: middle clavicle
STERNOSCAPULARIS							

	Strepsirhini						Tarsiiformes
	Daubentoniidae		Lemuridae			Galagidae	Tarsiidae
	Daubentonia **Owen, 1866**	***Daubentonia*** **Soligo, 2005**	***Hapalemur*** **Beddard, 1891**	***Lemur*** **Murie & Mivart, 1872**	***Lemur*** **Soligo, 2005**	***Otolemur*** **Murie & Mivart, 1872**	***Tarsius*** **Woollard, 1925**
CORACOBRACHIALIS	**coraco-brachialis** O: coracoid I: middle medial H	**coracobrachialis medius** O: coracoid I: distal medial H	**coraco-brachialis longus**	**coraco-brachialis short part** O: coracoid I: medial bicipital groove H	**coracobrachialis medius** O: coracoid I: distal medial H	**coraco-brachialis short part** O: coracoid I: medial bicipital groove H	**coraco-brachialis second portion** O: coracoid I: proximal medial H
CORACOBRACHIALIS	**coraco-brachialis** O: coracoid I: medial epicondylar ridge H	**coracobrachialis profundus** O: coracoid I: proximal medial H	**coraco-brachialis** I: proximal H	**coraco-brachialis long part** O: BBs I: distal medial H	**coracobrachialis profundus** O: coracoid I: proximal medial H	**coraco-brachialis long part** O: BBs I: distal medial H	**coraco-brachialis larger portion** O: BBs I: middle medial H
BICEPS BRACHII, short head	**biceps brachii** O: coracoid + glenoid I: R tuberosity	**biceps brachii** O: coracoid + glenoid I: R tuberosity	**biceps** O: coracoid + glenoid margin	**biceps** O: coracoid + glenoid margin I: R tuberosity	**biceps brachii** O: coracoid + glenoid I: R tuberosity	**biceps** O: coracoid I: R tuberosity	**biceps** O: coracoid + glenoid I: R tuberosity
BICEPS BRACHII, long head						**biceps** O: glenoid I: R tuberosity	
BRACHIALIS	**brachialis anticus** O: cranial + lateral H I: coronoid process U	**brachialis** O: cranial + lateral H I: coronoid process U	**brachialis anticus** O: radial side H	**brachialis anticus** O: lateral H I: coronoid process U	**brachialis** O: cranial + lateral H I: coronoid process U	**brachialis anticus** O: lateral H I: coronoid process U	**brachialis anticus** O: lateral H I: coronoid process U
CUBITALIS							
SUPRASPINATUS		**supraspinatus** O: supraspinous fossa I: GT		**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT
INFRASPINATUS		**infraspinatus** O: infraspinous fossa I: GT		**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus (divided)** O: infraspinous fossa I: GT
TRICEPS BRACHII CAPUT LATERALE	**triceps ext antibrachii, external portion** O: LT I: lateral olecranon	**triceps brachii caput laterale** O: caudo-lateral head H I: olecranon	**triceps, second head** O: head H	**triceps brachii outer head** O: caudo-lateral head H I: olecranon	**triceps brachii caput laterale** O: GT + caudo-lateral H I: olecranon	**triceps brachii outer head** O: caudo-lateral head H I: olecranon	**triceps, lateral head** O: GT I: olecranon

	Strepsirhini						Tarsiiformes
	Daubentoniidae		Lemuridae			Galagidae	Tarsiidae
	Daubentonia **Owen, 1866**	***Daubentonia*** **Soligo, 2005**	***Hapalemur*** **Beddard, 1891**	***Lemur*** **Murie & Mivart, 1872**	***Lemur*** **Soligo, 2005**	***Otolemur*** **Murie & Mivart, 1872**	***Tarsius*** **Woollard, 1925**
TRICEPS BRACHII CAPUT MEDIALE	**triceps ext antibrachii, internal portion** O: caudo-medial H I: olecranon	**triceps brachii caput mediale** O: caudo-medial + lateral H I: olecranon	**triceps, third head** O: shaft H	**triceps brachii upper part of inner head** O: caudo-medial H I: olecranon	**triceps brachii caput mediale** O: caudo-medial + lateral H I: olecranon	**triceps brachii upper part of inner head** O: caudo-medial H I: olecranon	**triceps, medial head** O: medial bicipital groove H I: olecranon
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps ext antibrachii, long portion** O: facet near glenoid I: olecranon	**triceps brachii caput longum** O: caudal border scapula I: olecranon	**triceps, long head** O: caudal border scapula	**triceps brachii long head** O: caudal border scapula I: olecranon	**triceps brachii caput longum** O: caudal border scapula I: olecranon	**triceps brachii long head** O: caudal border scapula I: olecranon	**triceps, long head** O: caudal border scapula I: olecranon
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)							
TRICEPS BRACHII ACCESSORY							
ANCONEUS	**anconeus sextus** O: lateral supracondylar ridge H I: olecranon	**anconeus lateralis** O: caudal lateral epicondyle I: olecranon	**triceps ? fourth head**	**anconeus** O: caudal lateral epicondyle I: olecranon	**anconeus lateralis** O: caudal lateral epicondyle I: olecranon	**anconeus** O: caudal lateral epicondyle I: olecranon	**anconeus proper** O: distal caudal H I: olecranon
BRACHIORADIALIS	**supinator longus** O: middle H + lateral supracondylar ridge H I: distal lateral R	**brachioradialis** O: supinator crest H + TLA I: distal R		**supinator longus** O: lateral supracondylar ridge H I: distal R	**brachioradialis** O: supinator crest H I: distal R	**supinator longus** O: lateral supracondylar ridge H I: styloid process R	**supinator longus** O: lateral supracondylar ridge H I: distal R
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis longus** O: lateral supracondylar ridge H I: base MC2	**ext carpi radialis longus** O: lateral supracondylar ridge H I: base MC2	**ext carpi radialis longior** O: lateral supracondylar ridge H I: MC2	**ext carpi radialis longior** O: lateral supracondylar ridge H I: base MC2	**ext carpi radialis longus** O: lateral supracondylar ridge H I: base MC2	**ext carpi radialis longior** O: lateral supracondylar ridge H I: base MC2	**ext carpi radialis longus** O: lateral supracondylar ridge H I: base MC2

	Strepsirhini						Tarsiiformes
	Daubentoniidae		Lemuridae			Galagidae	Tarsiidae
	Daubentonia **Owen, 1866**	***Daubentonia*** **Soligo, 2005**	***Hapalemur*** **Beddard, 1891**	***Lemur*** **Murie & Mivart, 1872**	***Lemur*** **Soligo, 2005**	***Otolemur*** **Murie & Mivart, 1872**	***Tarsius*** **Woollard, 1925**
EXT CARPI RADIALIS, brevis (MC3)	**ext carpi radialis brevis** O: lateral epicondyle I: MC3	**ext carpi radialis brevis** O: lateral epicondyle I: MC3	**ext carpi radialis brevior** O: lateral epicondyle I: MC3	**ext carpi radialis brevior** O: lateral epicondyle I: MC3	**ext carpi radialis brevis** O: lateral epicondyle I: MC3	**ext carpi radialis brevior** O: lateral epicondyle I: MC3	**ext carpi radialis brevis** O: lateral epicondyle I: base MC3
EXT DIGITORUM COMMUNIS	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum** O: lateral epicondyle I: digits 2, 3, 4, 4, 5	**ext communis digitorum** I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum** O: lateral epicondyle I: EPL, digits 2, 3, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5
EXT DIGITORUM LATERALIS	**deep-seated ext** I: digits 4, 5	**ext digiti minimi** O: EDC + lateral epicondyle I: digits 4, 5	**ext minimi digiti** O: lateral epicondyle I: digits 4, 5	**ext minimi digiti** O: lateral epicondyle I: digits 4, 5	**ext digiti minimi** O: EDC + lateral epicondyle I: digits 4, 5	**ext minimi digiti** O: EDC I: digits 4, 5	**ext minimi digiti** O: EDC I: EDC4, EDC5
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + U	**ext carpi ulnaris** O: lateral epicondyle + U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + U I: base MC5
SUPINATOR		**supinator** O: lateral epicondyle + annular ligament R I: R			**supinator** O: annular ligament R + U I: R		**supinator brevis** O: lateral epicondyle I: cranial R
ABD POLLICIS LONGUS	**abd longus pollicis** O: lateral epicondyle I: MC1	**abd pollicis longus** O: interosseus membrane + U I: radial sesamoid + base MC1	**ext ossis metacarpi pollicus** O: R + interosseus membrane I: MC1	**ext ossis metacarpi pollicus** O: R I: digit 1	**abd pollicis longus** O: R + U I: radial sesamoid + base MC1	**ext ossis metacarpi pollicus** O: R I: digit 1	**abd longus pollicis** O: proximal 2/3 R I: base MC1
EXT DIGITORUM PROFUNDUS	**indicator** O: middle U + interosseus ligament I: digits 2, 3	**ext digitorum profundus** O: U + FDS I: digits 2, 3, 4	**ext indicis** O: U I: digit 2, EDL	**ext indicis** O: U I: digits 2, 3, (4)	**ext digitorum profundus** O: lateral U I: digits 2, 3	**ext indicis + ext medii digiti** O: U I: digits 2, 3	**ext indicis** O: middle U I: digits 2, 3, 4
EXT POLLICIS LONGUS	**ext longus pollicis** O: proximal U I: digit 1	**ext pollicis longus** O: U I: digit 1	**ext secundi internodii pollicis** O: U I: digit 1	**ext secundi internodii pollicis** O: U I: digit 1	**ext pollicis longus** O: U I: digit 1	**ext secundi internodii pollicis** O: U I: digit 1	**ext longus pollicus** O: U I: digits 1, 2

	Strepsirhini						Tarsiiformes
	Daubentoniidae		Lemuridae			Galagidae	Tarsiidae
	Daubentonia **Owen, 1866**	***Daubentonia*** **Soligo, 2005**	***Hapalemur*** **Beddard, 1891**	***Lemur*** **Murie & Mivart, 1872**	***Lemur*** **Soligo, 2005**	***Otolemur*** **Murie & Mivart, 1872**	***Tarsius*** **Woollard, 1925**
EXT POLLICIS BREVIS				**ext primi internodii pollicus** absent		**ext primi internodii pollicus** absent	**ext pollicis brevis** absent
EXT BREVIS DIGITORUM							
PRONATOR TERES	**pronator teres** O: medial epicondyle I: proximal R	**pronator teres** O: medial epicondyle I: cranio-lateral R		**pronator radii teres** O: medial epicondyle I: cranio-lateral R	**pronator teres** O: medial epicondyle I: cranio-lateral R	**pronator radii teres** O: medial epicondyle I: cranio-lateral R	**pronator radii teres** O: medial epicondyle I: R
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: base MC2	**flx carpi radialis** O: medial epicondyle I: base MC2		**flx carpi radialis** O: medial epicondyle I: base MC2	**flx carpi radialis** O: medial epicondyle I: base MC2	**flx carpi radialis** O: medial epicondyle I: base MC2	**flx carpi radialis** O: medial epicondyle I: base MC2
PALMARIS LONGUS	**palmaris longus** O: medial epicondyle I: vola-carpal ligament	**palmaris longus** O: medial epicondyle I: palmar fascia	**palmaris longus** O: medial epicondyle	**palmaris longus** O: medial epicondyle I: palmar fascia	**palmaris longus** O: medial epicondyle	**palmaris longus** O: medial epicondyle I: palmar fascia	**palmaris longus** O: medial epicondyle I: palmar fascia
FLX DIGITORUM SUPERFICIALIS	**flx digitorum sublimis** O: medial epicondyle + cornoid process U I: digits 2f, 3f, 4f, 5f	**flx digitorum superficialis, superficial** O: medial U I: digit 4f **flx digitorum superficialis, deeper** O: medial epicondyle + coronoid process U I: digits 2f, 3f, 5f, FDP	**flx sublimis digitorum** O: medial epicondyle I: digits 2, 3, 4, 5	**flx sublimis digitorum** O: medial epicondyle I: digits 2f, 3f, 4f, 5f	**flx digitorum superficialis** O: medial epicondyle I: digit 2f, 3f, 4f, 5f	**flx sublimis digitorum** O: medial epicondyle I: digits 2f, 3f, 4f, 5f	**flx sublimis digitorum** O: medial epicondyle I: digits 2f, 3f, 4f, 5f
INTERFLEXORII	**FDS - FDP**		**FDS - FDP**	**FDS - FDP**		**FDS - FDP**	**FDS - FDP / FPL - FDP**

	Strepsirhini						Tarsiiformes
	Daubentoniidae		Lemuridae			Galagidae	Tarsiidae
	Daubentonia **Owen, 1866**	***Daubentonia*** **Soligo, 2005**	***Hapalemur*** **Beddard, 1891**	***Lemur*** **Murie & Mivart, 1872**	***Lemur*** **Soligo, 2005**	***Otolemur*** **Murie & Mivart, 1872**	***Tarsius*** **Woollard, 1925**
FLX DIGITORUM PROFUNDUS,	**flx profundus + flx longus pollicis**	**flx digitorum profundus**	**flx profundus digitorum + flx longus pollicis**	**flx profundus digitorum + flx longus pollicis**	**flx digitorum profundus**	**flx profundus digitorum + flx longus pollicis**	**flx profundus digitorum + flx pollicis longus**
epicondylar							O: medial epicondyle (FPL)
epicondylar (FDPe)	O: medial epicondyle (FDP)	O: medial epicondyle I: digits 1, 2, 3	O: medial epicondyle (FPL)		O: medial epicondyle I: digits 1, 2, 3	O: medial epicondyle	O: medial epicondyle
epicondylar (FDPd)	O: R + interosseus membrane (FPL)	O: U I: digits 4, 5			O: U + interosseus membrane I: digits 4, 5	O: medial epicondyle + U	O: medial U + interosseus membrane
ulnar	O: middle U (FDP)	O: 3/4 U + olecranon I: digits 4, 5	O: U	O: U	O: medial ulna I: digits 4, 5	O: U	O: proximal 2/3 medial U
radial	O: proximal R + middle U (FPL) *I: digits (1, 2), 3, 4, 5	O: R I: digits 1, 2, 3 *I: digits 1, 2, 3, 4, 5	O: R (FPL)	O: R *I: digits 1, 2, 3, 4, 5	O: R + interosseus membrane I: digits 1, 2, 3 *I: digits 1, 2, 3, 4, 5	O: R *I: digits 1, 2, 3, 4, 5	O: R (FPL) *I: digits 1, 2, 3, 4, 5
LUMBRICALES	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5		**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5
FLX CARPI ULNARIS, epitrochlear belly	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris** "not remarkable"	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris** O: medial epicondyle
ulnar belly	O: medial olecranon I: pisiform + MC5	O: medial olecranon I: pisiform + MC5		O: medial olecranon I: pisiform + MC5	O: medial U	O: medial olecranon I: pisiform + MC5	O: aponeurosis from U I: pisiform + MC5
EPITROCHLEO-ANCONEUS		**epitrochleo-anconeus** O: caudal medial epicondyle I: olecranon		**triceps brachii lower part of inner head** O: distal medial H I: olecranon	**epitrochleo-anconeus** O: caudal medial epicondyle	**triceps brachii lower part of inner head** O: distal medial H I: olecranon	
PRONATOR QUADRATUS	**pronator quadratus** O: distal 1/4 U + R	**pronator quadratus** O: distal 1/4 U + R		**pronator quadratus** O: distal 1/4 U + R	**pronator quadratus** O: distal 1/4 U + R	**pronator quadratus** O: distal 1/4 U + R	**pronator quadratus** O: distal 1/4 U + R
PALMARIS BREVIS		**palmaris brevis**		**palmaris brevis** O: fascia pisiform I: skin ulnar side of palm		**palmaris brevis** present	**palmaris brevis** present

	Strepsirhini						**Tarsiiformes**
	Daubentoniidae		**Lemuridae**			**Galagidae**	**Tarsiidae**
	Daubentonia **Owen, 1866**	***Daubentonia*** **Soligo, 2005**	***Hapalemur*** **Beddard, 1891**	***Lemur*** **Murie & Mivart, 1872**	***Lemur*** **Soligo, 2005**	***Otolemur*** **Murie & Mivart, 1872**	***Tarsius*** **Woollard, 1925**
FLX DIGITORUM BREVIS MANUS							
ABD DIGITI MINIMI	**abd minimus** present	**abd digiti minimi** O: pisiform I: digit 5		**abd digiti minimi** O: pisiform I: digit 5	**abd digiti minimi** O: pisiform I: digit 5	**abd digiti minimi** O: pisiform I: digit 5	**abd digiti minimi** O: unciform I: digit 5
ABD POLLICIS BREVIS	**abd pollex** present	**abd pollicis brevis** I: digit 1		**abd pollicis** O: annular ligament + radial sesamoid I: digit 1	**abd pollicis brevis** I: digit 1	**abd pollicis** O: annular ligament + radial sesamoid I: digit 1	**abd brevis pollicis** O: transverse carpal ligament + trapezium I: digit 1
CONTRAHENTES	**add pollex, add minimus** I: digits 1L, 5M	**contrahentes digitorum** O: capitate + MC4 I: digits 1L, 2L, 5M		**add pollicis, interossei superficiales** O: MC2 + 3 I: digits 1L, 2L, 5M	**contrahentes digitorum** O: capitate + MC3 I: digits 1L, 2L, 3L, 4M, 5M	**add pollicis, interossei superficiales** O: MC2 + 3 I: digits 1L, 2L, 5M	**add pollicis** O: MC3 I: digits 1L
FLEXOR BREVES PROFUNDUS		**interossei palmares + interossei dorsales** [8]		**flx pollicis brevis, flx brevis minimi digiti, opp minimi digiti, interossei** [9]	**interossei palmares + interossei dorsales** [8]	**flx pollicis brevis, flx brevis minimi digiti, opp minimi digiti, interossei** [9]	**flx pollicis brevis, palmar and dorsal interossei** [9]
INTERMETACARPALES							
? Unknown homology		**opp pollicis** I: digit 1		**opp pollicis** O: trapezium I: base MC1	**opp pollicis** I: digit 1	**opp pollicis** O: trapezium I: base MC1	**opp pollicis** O: trapezium + transverse carpal ligament I: MC1
? Unknown homology		**opp digiti minimi** I: digit 5			**opp digiti minimi** I: digit 5		**opp minimi digiti** O: MC3 I: MC5
? Unknown homology		**distrahens digiti quarti** I: digit 4			**distrahens digiti quarti** I: digit 4		
RADIAL SESAMOID "PRE-POLLUX"							
ULNAR SESAMOID							
CARPAL VIBRISSAE							

	Platyrrhini			Catarrhini					
	Atelidae	Cebidae		Cercopithecidae					
	Alouatta **Schön, 1968**	***Callimico*** **Hill, 1959**	***Callithrix*** **Beattie, 1927**	***Cercopithecus*** **Soligo, 2005**	***Chlorocebus*** **Dobson, 1881**	***Macaca*** **Patterson, 1942**	***Mandrillus*** **Sonntag, 1922a**	***Rhinopithecus*** **Patterson, 1942**
PANNICULUS CARNOSUS			**panniculus carnosus** "connect PS w/ LD" I: fascia CB + H			**panniculus carnosus** O: back + sides I: w/ PA + lateral bicipital groove H	**axelbogen** O: LD I: aponeurosis of biceps	
STERNO-FACIALIS									
STERNOMASTOIDEUS	**sternocleidomastoideus** O: mastoid I: medial clavicle + sternum	**sterno-mastoideus** O: mastoid + nuchal crest w/ CM I: sternum	**sternomastoid** O: mastoid I: sternum		**sterno-mastoid** O: w/ CM		**sternomastoid** O: mastoid region + occipital crest I: manubrium	**sternomastoid "sternal head"** O: mastoid area I: manubrium
CLEIDOMASTOIDEUS		**cleido-occipitalis** O: mastoid + nuchal crest w/ SM I: medial clavicle	**cleido-occipitalis** O: nuchal crest I: medial clavicle		**cleido-mastoid** O: w/ SM		**cleidomastoid** O: mastoid region + occipital crest I: medial clavicle	**sternomastoid "clavicular head"** O: mastoid area I: medial clavicle
CLAVOTRAPEZIUS		**cleido-occipitalis** "occipital slip"			**cleido-occipital** O: occiput			
CEPHALOHUMERALIS									
ACROMIOTRAPEZIUS	**trapezius** O: occiput, ligamentum nuchae, T1-8 I: lateral clavicle, acromion, acromioclavicular joint	**trapezius** O: C4-T8 I: lateral clavicle, acromion, spine scapula	**trapezius "supra"** O: C3-T4 I: spine scapula	**trapezius** O: occiput, ligamentum nucahe, T1-8 I: acromion + spine scapula deep to OT	**trapezius** O: occiput I: lateral clavicle, acromion, spine scapula	**trapezius** O: occiput, ligamentum nuchae, T1-10 I: lateral clavicle, acromion, spine scapula superficial to OT	**trapezius** O: occipital crest, ligamentum nuchae, T1-6 I: "as in man"	**trapezius** O: occiput, ligamentum nuchae, T1-8 I: lateral clavicle, acromion, spine scapula superficial to OT
DORSO-CUTANEUS			**trapezius "infra"** O: T4-10 I: spine scapula					
SPINOTRAPEZIUS									

	Platyrrhini			Catarrhini				
	Atelidae	**Cebidae**		**Cercopithecidae**				
	Alouatta **Schön, 1968**	***Callimico*** **Hill, 1959**	***Callithrix*** **Beattie, 1927**	***Cercopithecus*** **Soligo, 2005**	***Chlorocebus*** **Dobson, 1881**	***Macaca*** **Patterson, 1942**	***Mandrillus*** **Sonntag, 1922a**	***Rhinopithecus*** **Patterson, 1942**
RHOMBOIDEUS CAPITIS	**rhomboideus** O: lambdoid crest, ligamentum nuchae, C7-T4 I: vertebral border scapula	**r. capitis** O: nuchal crest occiput I: cranial angle scapula	**r. capitis** O: occiput, C4-7 I: cranial angle scapula	**rhomboideus capitis** I: cranial angle scapula	**rhomboideus** O: occiput I: deep surface vertebral border scapula	**rhomboideus capitis** O: nuchal crest I: vertebral border scapula		**rhomboideus capitis** O: nuchal crest I: vertebral border scapula
RHOMBOIDEUS CERVICIS		**rhomboideus proprius** O: C6-T4 I: caudal angle + vertebral border scapula	**rhomboideus** O: ligamentum nuchae, T1-3 I: vertebral border scapula	**rhomboideus** O: C4-T6 I: cranial border scapula	**rhomboideus** O: ligamentum nuchae-T3 I: deep surface vertebral border scapula	**rhomboideus minor** O: ligamentum nuchae, C7-T1 I: vertebral border scapula	**rhomboids** O: C7-T5 I: deep surface vertebral border scapula	**rhomboideus major and minor** O: occiput, C2-T5 I: vertebral border scapula
RHOMBOIDEUS THORACIS						**rhomboideus major** O: T2-6 I: vertebral border scapula		
OMOTRANSVERSARIUS "metacromion"	**atlantoscapularis anterior** O: atlas I: lateral clavicle, acromion superficial to AT	**levator scapulae anticus** O: atlas I: acromion	**levator scapulae anticus** O: atlas I: acromion	**atlantoscapularis anterior** I: acromion + spine scapula	**levator claviculae** O: atlas I: acromion + lateral clavicle	**omo-trachelian** O: atlas I: acromion + spine scapula	**omo-trachelian** I: supraspinous fossa + spine scapula	**omo-trachelian** O: atlas I: acromion + spine scapula
OMOTRANSVERSARIUS	**atlantoscapularis posterior** O: atlas I: cranial angle scapula				**levator claviculae** O: atlas I: spine scapula			
OMOHYOIDEUS	**omohyoid** O: hyoid I: cranial border scapula	**omohyoideus** O: hyoid I: ossified suprascapular ligament	**omo-hyoid** O: hyoid I: cranial border scapula		**omo-hyoid** "small"		**omo-hyoid** O: hyoid	
SERRATUS VENTRALIS CERVICIS	**serratus anterior pars cranialis** O: C2-7, ribs 1-2 I: cranial vertebral border scapula	**levator scapulae** O: C2-5 I: cranial angle scapula w/ SVT	**levator angulae scapulae** O: C3-5 I: cranial angle scapula		**levator anguli scapulae** O: C1-2 I: cranial angle scapula		**levator anguli scapulae** O: C4-7 I: deep surface vertebral border scapula	

	Platyrrhini			Catarrhini					
	Atelidae	Cebidae		Cercopithecidae					
	Alouatta **Schön, 1968**	*Callimico* **Hill, 1959**	*Callithrix* **Beattie, 1927**	*Cercopithecus* **Soligo, 2005**	*Chlorocebus* **Dobson, 1881**	*Macaca* **Patterson, 1942**	*Mandrillus* **Sonntag, 1922a**	*Rhinopithecus* **Patterson, 1942**
SERRATUS VENTRALIS THORACIS	**serratus anterior** O: ribs 3-8 I: vertebral border scapula	**serratus ventralis** O: C6-7, ribs 1-8 I: cranial angle scapula w/ SVC	**serratus magnus** O: ribs 1-9 I: vertebral border scapula	**serratus anterior** I: vertebral border scapula	**serratus magnus** O: C3-5	**serratus anterior** O: C6-7, ribs 1-9 I: vertebral border scapula	**serratus magnus** O: ribs 1-10 I: vertebral border scapula	**serratus anterior** O: C6-7, ribs 1-8 I: vertebral border scapula
CLAVODELTOIDEUS	**deltoideus pars clavicularis** O: lateral clavicle I: w/ PS + w/ SD	**cleido-deltoideus** O: lateral clavicle I: AD	**deltoid, clavicular** O: lateral clavicle I: lateral bicipital ridge H			**deltoid, clavicular head** O: clavicle I: deltoid marking on H		
ACROMIODELTOIDEUS	**deltoideus pars acromialis** O: acromion I: proximal 1/3 H	**acromio-deltoideus** O: acromion I: lateral H	**deltoid, acromial** O: acromion + spine scapula I: lateral bicipital ridge H	**deltoideus pars acromialis** O: acromion	**deltoid** I: w/ PS	**deltoid, acromial head** O: acromion I: deltoid marking on H	**deltoid** O: clavicle, acromion, spine scapula I: "usual deltoid insertion"	**deltoid (2 parts)** O: lateral clavicle, acromion, spine scapula I: deltoid crest cranio-lateral H
SPINODELTOIDEUS	**deltoideus pars spinalis**	**spino-deltoideus** O: spine scapula I: AD	**deltoid, spinal** O: spine scapula I: lateral bicipital ridge H	**deltoideus pars spinalis** O: spine scapula	**deltoid, scapular portion**	**spino-deltoid** O: spine scapula I: deltoid marking on H		
TERES MINOR	**teres minor** O: caudal border scapula I: GT	**teres minor** O: caudal border scapula I: distal GT	**teres minor** O: caudal border scapula I: distal GT	**teres minor** O: caudal border scapula I: GT		**teres minor** O: caudal border scapula I: distal GT	**teres minor** O: "as in man" I: distal GT	**teres minor** O: caudal border scapula I: distal GT
SUBSCAPULARIS	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT		**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT
TERES MAJOR	**teres major** O: caudal angle + border scapula I: medial H	**teres major** O: caudal angle scapula I: bicipital groove H	**teres major** O: caudal angle + border scapula I: medial bicipital groove H	**teres major** O: caudal border scapula I: H		**teres major** O: caudal angle + border scapula I: medial bicipital groove H	**teres major** O: "as in man" I: w/ LD	**teres major** O: caudal border scapula I: medial bicipital groove H
LATISSIMUS DORSI "superficial" "deep"	**latissimus dorsi** O: T7-L2, thoracolumbar fascia, ribs 8-12 I: sulcus intertubercularis	**latissimus dorsi** O: T8-12, lumbar aponeurosis, ribs 9-12 I: bicipital groove H	**latissimus dorsi** O: T4-L3 + lumbo-dorsal fascia I: bicipital groove H	**latissimus dorsi** O: T5-12, lumbar fascia I: H I: w/ TMA	**latissimus dorsi** I: bicipital groove I: w/ TMA	**latissimus dorsi** O: T6-12, lumbar aponeurosis, iliac crest I: bicipital groove H	**latissimus dorsi** O: T4-12, lumbar aponeurosis I: distal pectoral crest H w/ TMA	**latissimus dorsi** O: T6-12, lumbar aponeurosis, iliac crest I: bicipital groove H

	Platyrrhini			Catarrhini				
	Atelidae	Cebidae		Cercopithecidae				
	Alouatta **Schön, 1968**	***Callimico*** **Hill, 1959**	***Callithrix*** **Beattie, 1927**	***Cercopithecus*** **Soligo, 2005**	***Chlorocebus*** **Dobson, 1881**	***Macaca*** **Patterson, 1942**	***Mandrillus*** **Sonntag, 1922a**	***Rhinopithecus*** **Patterson, 1942**
DORSO-EPITROCHLEARIS	**dorsi-epitrochlearis** O: LD I: medial epicondyle + olecranon	**latissimo-epicondyloideus** O: LD I: fascia medial epicondyle	**dorsi-epitrochlearis** O: LD I: deep to TLO	**dorso-epitrochlearis** O: LD I: medial epicondyle + olecranon	**dorso-epitrochlearis** O: LD I: caudo-medial arm	**dorsi-epitrochlearis** O: LD I: medial olecranon	**dorso-epitrochlearis** O: LD + TMA I: medial epicondyle + olecranon	**dorsi-epitrochlearis** O: LD I: medial olecranon
PECTORALIS SUPERFICIALIS "clavicular"	**pectoralis major, sternoclavicular** O: medial clavicle + manubrium I: GT w/ PS	**pectoralis major, sterno-clavicularis anterior** O: deep surface PSs I: medial clavicle + SC						
PECTORALIS SUPERFICIALIS "superficial"	**pectoralis major, sternocostalis** O: sternum + ribs I: GT w/ PS	**pectoralis major, principal portion** O: manubrium + sternum I: lateral bicipital ridge H	**pectoralis major pars sternalis** O: sternum I: medial bicipital ridge H		**pectoralis major** O: clavicle, sternum	**pectoralis major** O: sternum, sterno-clavicular joint, abdomen I: lateral bicipital groove H	**pectoralis major, first part** O: medial clavicle, sternum, ribs, rectus abdominis I: w/ deltoid, GHj capsule, pectoral ridge H	**pectoralis major** O: sternum, sterno-clavicular joint, abdomen I: lateral bicipital groove H
PECTORALIS SUPERFICIALIS "deep"	**pectoralis major, caudal** O: rectus sheath I: GT w/ PS							
PECTORALIS PROFUNDUS	**pectoralis minor** O: sternum + ribs 3-5 I: coracohumeral ligament	**pectoralis minor** O: ribs 3-6 I: GHj capsule	**pectoralis minor** O: ribs 2-6 I: GT + acromion		**pectoralis minor, anterior** O: ribs 3-6 I: GHj capsule	**pectoralis minor** O: ribs 3-6 I: GHj capsule, coracoid process	**pectoralis major, third part** O: ribs 2-5 I: GHj capsule, w/ PA	**pectoralis minor** O: ribs 2-4 I: GHj capsule, coracoid process
PECTORALIS ABDOMINALIS	**pectoralis abdominalis** O: rectus sheath I: LT	**pectoralis abdominis** O: rectus sheath ribs 8-9 I: GHj capsule, fascia over biceps	**pectoralis major pars abdominalis** O: linea alba, ribs 9-10 I: pectoral crest H, GHj capsule		**pectoralis minor, posterior** O: external oblique I: lateral bicipital groove + w/ PP	**pectoralis abdominis** O: rectus sheath I: LT	**pectoralis major, second part** O: external oblique I: PSs	**pectoralis abdominis** O: rectus sheath I: lateral bicipital groove H
SUBCLAVIUS	**subclavius** O: rib 1 I: clavicle + coracoid	**subclavius** O: rib 1 I: clavicle	**subclavius** O: rib 1 I: lateral clavicle			**subclavius** O: rib 1 I: middle clavicle	**subclavius** O: rib 1 I: clavicle	**subclavius** O: rib 1 I: middle clavicle
STERNOSCAPULARIS								

	Platyrrhini			Catarrhini				
	Atelidae	**Cebidae**		**Cercopithecidae**				
	Alouatta **Schön, 1968**	***Callimico*** **Hill, 1959**	***Callithrix*** **Beattie, 1927**	***Cercopithecus*** **Soligo, 2005**	***Chlorocebus*** **Dobson, 1881**	***Macaca*** **Patterson, 1942**	***Mandrillus*** **Sonntag, 1922a**	***Rhinopithecus*** **Patterson, 1942**
CORACOBRACHIALIS	**coracobrachialis pars profunda** O: coracoid I: neck H	**coraco-brachialis medius** O: coracoid w/ BBs I: middle medial H	**coraco-brachialis deep part** O: coracoid I: proximal medial H	**coracobrachialis medius** O: coracoid I: middle medial H	**coraco-brachialis** O: w/ BBs I: proximal H, slip to R w/ BB	**coraco-brachialis profundus** O: CB I: medial neck H	**coraco-brachialis** O: coracoid I: shaft H near deltoid ins	**coraco-brachialis "medius"** O: coracoid I: middle medial H
CORACOBRACHIALIS	**coracobrachialis pars media** O: CB I: middle medial H	**coraco-brachialis longus** O: coracoid w/ BBs I: medial supracondylar process H	**coraco-brachialis superficial part** O: coracoid w/ BBs I: medial epicondylar ridge H	**coracobrachialis profundus** O: coracoid I: proximal medial H	**coraco-brachialis brevis** I: neck H	**coraco-brachialis** O: coracoid w/ BBs I: middle medial H		
BICEPS BRACHII, short head	**biceps brachii** O: coracoid + glenoid I: R tuberosity	**biceps brachii** O: coracoid + glenoid I: R tuberosity	**biceps** O: coracoid + glenoid I: R tuberosity	**biceps brachii** O: coracoid + glenoid I: R tuberosity	**biceps** I: R	**biceps** O: coracoid + supraglenoid tuberosity I: R tuberosity	**biceps** O: coracoid + supraglenoid tuberosity I: proximal R	**biceps** O: coracoid + supraglenoid tuberosity I: R tuberosity
BICEPS BRACHII, long head								
BRACHIALIS	**brachialis** O: distal lateral + medial H I: coronoid process U	**brachialis** O: lateral H I: coronoid process U	**brachialis anticus** O: lateral H + lateral supracondylar ridge I: coronoid process U	**brachialis** O: cranial + lateral H I: coronoid process U		**brachialis anterior** O: cranial H I: coronoid process U	**brachialis anticus** O: "as in man" I: medial U	**brachialis anterior** O: cranial H I: coronoid process U
CUBITALIS								
SUPRASPINATUS	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT		**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT
INFRASPINATUS	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT		**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT (2 heads)	**infraspinatus** O: infraspinous fossa I: GT
TRICEPS BRACHII CAPUT LATERALE	**triceps caput laterale** O: proximal caudal H I: tip olecranon w/ TLO	**triceps extensor brachii, lateral head** O: distal to GT I: olecranon, TLO	**triceps, lateral head** O: GT I: olecranon, TLO	**triceps brachii caput laterale** O: caudo-lateral head H I: olecranon		**triceps, lateral head** O: proximal caudal H I: olecranon w/ TLO	**triceps, humeral heads** I: olecranon	**triceps, lateral head** O: proximal caudal H I: olecranon

	Platyrrhini			Catarrhini				
	Atelidae	Cebidae		Cercopithecidae				
	Alouatta **Schön, 1968**	***Callimico*** **Hill, 1959**	***Callithrix*** **Beattie, 1927**	***Cercopithecus*** **Soligo, 2005**	***Chlorocebus*** **Dobson, 1881**	***Macaca*** **Patterson, 1942**	***Mandrillus*** **Sonntag, 1922a**	***Rhinopithecus*** **Patterson, 1942**
TRICEPS BRACHII CAPUT MEDIALE	**triceps caput mediale** O: caudal H I: tip olecranon	**triceps extensor brachii, medial head** O: shaft H I: olecranon	**triceps, medial head** O: shaft H I: olecranon	**triceps brachii caput mediale** O: caudal H I: olecranon		**triceps, medial head** O: caudal H I: olecranon	**triceps, humeral heads** I: olecranon	**triceps, medial head** O: caudo-medial H I: olecranon
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps caput longum** O: caudal border scapula, spine scapula I: olecranon w/ TLA	**triceps extensor brachii, long head** O: neck + caudal border scapula I: olecranon w/ TLA	**triceps, long head** O: glenoid + caudal border scapula I: olecranon	**triceps brachii caput longum** O: caudal border scapula I: olecranon		**triceps, long head** O: infraglenoid tubercle + caudal border scapula I: olecranon	**triceps, long head** O: caudal border scapula, w/ D-E I: olecranon	**triceps, long head** O: infraglenoid tubercle + caudal border scapula I: olecranon
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)								
TRICEPS BRACHII ACCESSORY						**subanconaeus** "few fibers in olecranon fossa"		
ANCONEUS	**anconeus** O: distal caudal H I: olecranon	**anconeus** O: lateral epicondyle I: olecranon	**anconeus** O: distal caudal H I: olecranon + w/ triceps	**anconeus lateralis** O: caudal lateral epicondyle I: olecranon		**anconaeus** O: caudal lateral epicondyle I: lateral olecranon		
BRACHIORADIALIS	**supinator longus** O: lateral supracondylar ridge H I: styloid process R	**brachio-radialis** O: lateral supracondylar ridge H I: styloid process R	**supinator longus** O: lateral supracondylar ridge H I: styloid process R	**brachioradialis** O: lateral H I: distal R		**brachio-radialis** O: lateral supracondylar ridge I: styloid process R		**brachioradialis** O: lateral supracondylar ridge I: styloid process R
EXT CARPI RADIALIS, longus (MC2)	**ext carpi radialis longus** O: lateral supracondylar ridge H I: base MC2	**radial extensors, ext carpi radialis longior** O: lateral supracondylar ridge H I: base MC2	**ext carpi radialis longus** O: lateral supracondylar ridge H I: base MC1	**ext carpi radialis longus** O: lateral supracondylar ridge H I: base MC2		**ext carpi radialis longus** O: lateral supracondylar ridge I: base MC2		**ext carpi radialis longus** O: lateral supracondylar ridge I: base MC2

	Platyrrhini			**Catarrhini**				
	Atelidae	**Cebidae**		**Cercopithecidae**				
	Alouatta **Schön, 1968**	***Callimico*** **Hill, 1959**	***Callithrix*** **Beattie, 1927**	***Cercopithecus*** **Soligo, 2005**	***Chlorocebus*** **Dobson, 1881**	***Macaca*** **Patterson, 1942**	***Mandrillus*** **Sonntag, 1922a**	***Rhinopithecus*** **Patterson, 1942**
EXT CARPI RADIALIS, brevis (MC3)	**ext carpi radialis brevis** O: lateral epicondyle I: base MC3	**radial extensors** O: lateral supracondylar ridge H I: base MC3	**ext carpi radialis brevis** O: lateral supracondylar ridge H I: base MC2	**ext carpi radialis brevis** O: lateral epicondyle I: MC3		**ext carpi radialis brevis** O: lateral epicondyle I: base MC3		**ext carpi radialis brevis** O: lateral epicondyle I: base MC3
EXT DIGITORUM COMMUNIS	**ext digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 1, 2, 3, 4, 5	**ext digitorum** O: lateral epicondyle + ECRb I: EPL, digits 2, 3, 3, 4, 5	**ext communis digitorum** I: digits 2, 3, 4	**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5		**ext communis digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5
EXT DIGITORUM LATERALIS	**ext digiti quinti et quarti proprius** O: lateral epicondyle I: MC4 + digit 5	**ext digiti minimi** O: lateral epicondyle I: digits 4, 5	**ext minimi digiti** O: EDC I: digits 4, 5	**ext digiti minimi** O: EDC + lateral epicondyle I: digits 4, 5	**ext minimi digiti** I: digit 5, 5	**ext digiti quarti et quinti** O: EDC I: digits 4 + 5		**ext digiti quarti et quinti** O: lateral epicondyle I: digits 4 + 5
EXT CARPI ULNARIS	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + olecranon I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + olecranon I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5		**ext carpi ulnaris** O: lateral epicondyle + U I: base MC5		**ext carpi ulnaris** O: lateral epicondyle + U I: base MC5
SUPINATOR	**supinator** O: elbow joint capsule + U I: R	**supinator** O: orbicular ligament of R + lateral U I: proximal medial R		**supinator** O: lateral epicondyle + annular ligament R I: R		**supinator** O: lateral epicondyle + U I: R		**supinator** O: lateral epicondyle + U I: proximal 1/2 R
ABD POLLICIS LONGUS	**abd longus pollicis** O: R + U + interosseus membrane I: trapezium + radial sesamoid	**abd pollicis longus** O: interosseus membrane + U I: base MC1	**abd longus pollicis** O: proximal 2/3 R I: base MC1	**abd pollicis longus** O: R + U I: radial sesamoid + base MC1	**ext ossis metacarpi pollicis** I: MC1	**abd pollicis longus** O: U + R + interosseus I: base MC1 + trapezium		**abd pollicis longus** O: U + R + interosseus I: base MC1 + radial sesamoid
EXT DIGITORUM PROFUNDUS	**ext digiti tertii proprius** O: lateral U I: MC3, digit 4	**ext digitorum profundi** O: distal 3/4 U (2 heads) I: digits 1, 2, 3, 4	**ext indicis** O: proximal 2/3 U I: digits 1, 2, 3, slip to 4	**ext digitorum profundus** O: lateral U I: digits 2, 3	**ext indicis** I: digits 2, 3, 4	**ext digiti tertii et indicis** O: U + interosseus membrane I: digits 2 + 3		**ext indicis et digiti tertii** O: U + interosseus membrane I: digits 2 + 3
EXT POLLICIS LONGUS	**ext pollicus et indicus longus** O: proximal lateral U I: digits 1, 2	**ext pollicus longus** not differentiated	**ext longus pollicus** absent	**ext pollicis longus** O: U I: digit 1	**ext secundi internodii pollicis** I: digit 1	**ext pollicis longus** O: proximal U I: digit 1		**ext pollicis longus** O: proximal U I: digit 1

	Platyrrhini			**Catarrhini**				
	Atelidae	**Cebidae**		**Cercopithecidae**				
	Alouatta **Schön, 1968**	***Callimico*** **Hill, 1959**	***Callithrix*** **Beattie, 1927**	***Cercopithecus*** **Soligo, 2005**	***Chlorocebus*** **Dobson, 1881**	***Macaca*** **Patterson, 1942**	***Mandrillus*** **Sonntag, 1922a**	***Rhinopithecus*** **Patterson, 1942**
EXT POLLICIS BREVIS					**ext primi internodii pollicis** absent	**ext pollicis brevis** absent		**ext pollicis brevis** absent
EXT BREVIS DIGITORUM								
PRONATOR TERES	**pronator teres** O: medial epicondyle I: proximal R	**pronator teres** O: medial epicondyle I: middle R	**pronator radii teres** O: medial epicondyle I: middle 1/3 R	**pronator teres** O: medial epicondyle I: cranio-lateral R		**pronator teres** O: medial epicondyle + coronoid process U I: middle R		**pronator teres** O: medial epicondyle + coronoid process U I: middle 1/3 R
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle I: base MC2	**flx carpi radialis** O: medial epicondyle I: base MC2	**flx carpi radialis** O: medial epicondyle I: base MC2	**flx carpi radialis** O: medial epicondyle I: base MC3	**flx carpi radialis**	**flx carpi radialis** O: medial epicondyle I: base MC2 + MC3		**flx carpi radialis** O: medial epicondyle I: base MC2, slip to base MC3
PALMARIS LONGUS	**palmaris longus** O: distal medial epicondyle I: palmar aponeurosis	**palmaris longus** O: caudal medial epicondyle I: pisiform, scaphoid, palm	**palmaris longus** O: medial epicondyle I: palm	**palmaris longus** O: caudal medial epicondyle	**palmaris longus** O: w/ FCR I: palmar fascia	**palmaris longus** O: medial epicondyle I: palmar fascia		**palmaris longus** O: medial epicondyle I: palmar aponeurosis
FLX DIGITORUM SUPERFICIALIS	**flx digitorum superficialis caput superficiale** O: medial epicondyle I: digits 3f, 4f, 5f **flx digitorum superficialis caput profundum** O: medial epicondyle I: intermediate tendon; digit 2f	**flx digitorum sublimis (1)** O: medial epicondyle I: digits 2f, 3f, 4f **flx digitorum sublimis (2)** O: caudal medial epicondyle I: w/ FDP, 5f	**flx sublimis digitorum** O: medial epicondyle I: digits 2f, 3f, 4f, 5f	**flx digitorum superficialis** O: medial epicondyle w/ FDP I: digit 2f, 3f, 4f, 5f		**flx sublimis digitorum superficial part** O: medial epicondyle I: digits 2f, 3f, 4f, 5f		**flx sublimis digitorum** O: medial epicondyle, coronoid process, R, FCR I: digits 2f, 3f, 4f, 5f "large fleshy belly separates to join FDP to index"
INTERFLEXORII	**FDS - FDP**	**FDS(2) - FDP**	absent			**FDS - FDP**		**FDS - FDP**

	Platyrrhini			Catarrhini					
	Atelidae	**Cebidae**		**Cercopithecidae**					
	Alouatta **Schön, 1968**	***Callimico*** **Hill, 1959**	***Callithrix*** **Beattie, 1927**	***Cercopithecus*** **Soligo, 2005**	***Chlorocebus*** **Dobson, 1881**	***Macaca*** **Patterson, 1942**	***Mandrillus*** **Sonntag, 1922a**	***Rhinopithecus*** **Patterson, 1942**
FLX DIGITORUM PROFUNDUS,	**flx digitorum profundus**	**flx digitorum profundus + flx pollicis longus**	**flx profundus digitorum + flx pollicis longus**	**flx digitorum profundus**	**flx digitorum profundus**	**flx profundus digitorum (m+u)**		**flx profundus digitorum (m+u)**
epicondylar		O: distal medial epicondyle (FPL) I: digits 1, 2, 3						
epicondylar (FDPe)		O: distal medial epicondyle (FPL) I: digits 1, 2, 3	O: medial epicondyle	O: caudal medial epicondyle	O: ?			
epicondylar (FDPd)		O: distal U I: digits 3, 4, 5	O: R + medial epicondyle (FPL)					
ulnar	O: U	O: proximal 1/3 medial U + R I: digits 3, 4, 5	O: proximal 1/2 medial U	O: medial U	O: U	O: cranio-medial U		O: proximal 2/3 U
radial	O: R	O: R (FPL) I: digits 1, 2, 3	O: proximal 1/2 R	O: R	O: ?	O: cranial R		O: R
	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 1 (FPL), 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5		*I: digits 2, 3, 4, 5
LUMBRICALES	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricals (u)** O: FDP I: digits 2, 3, 4, 5	**lumbricals** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricals** O: FDP I: digits 2, 3, 4, 5		**lumbricals** O: FDP I: digits 2, 3, 4, 5
FLX CARPI ULNARIS, epitrochlear belly	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris** O: caudal medial epicondyle		**flx carpi ulnaris** O: medial epicondyle		**flx carpi ulnaris** O: medial epicondyle
ulnar belly	O: medial olecranon I: pisiform	O: medial olecranon I: pisiform + MC5	O: medial olecranon I: pisiform + MC5	O: medial U		O: U I: pisiform		O: U I: pisiform
EPITROCHLEO-ANCONEUS	**epitrochleo-anconeus** O: caudal medial epicondyle I: medial olecranon			**epitrochleo-anconeus** O: caudal medial epicondyle		**epitrochleo-anconeus** O: medial epicondyle I: medial olecranon		**epitrochleo-anconeus** absent
PRONATOR QUADRATUS	**pronator quadratus** O: distal 1/4 U + R	**pronator quadratus** O: distal U + R	**pronator quadratus** O: distal 1/4 U + R	**pronator quadratus** O: distal 1/4 U + R		**pronator quadratus** O: distal 1/4 R + U		**pronator quadratus** O: distal 1/4 R + U
PALMARIS BREVIS	**palmaris brevis** O: hypothenar eminence		**palmaris brevis** skin hypothenar pads		**palmaris brevis** O: pisiform + annular ligament			

	Platyrrhini			Catarrhini				
	Atelidae	**Cebidae**		**Cercopithecidae**				
	Alouatta **Schön, 1968**	***Callimico*** **Hill, 1959**	***Callithrix*** **Beattie, 1927**	***Cercopithecus*** **Soligo, 2005**	***Chlorocebus*** **Dobson, 1881**	***Macaca*** **Patterson, 1942**	***Mandrillus*** **Sonntag, 1922a**	***Rhinopithecus*** **Patterson, 1942**
FLX DIGITORUM BREVIS MANUS								
ABD DIGITI MINIMI	**abd digiti quinti** O: pisiform I: MC5	**abd digiti minimi** O: hamatum + flx retinaculum I: digit 5	**abd digiti minimi** O: pisiform + unciform I: digit 5	**abd digiti minimi** O: pisiform I: digit 5	**abd minimi digiti** O: pisiform + annular ligament I: "usual"	**abd digiti quinti** O: pisiform + FCU I: digit 5		**abd digiti minimi** O: pisiform + flx retinaculum I: digit 5
ABD POLLICIS BREVIS	**abd pollicis brevis** O: flx retinaculum, navicular, radial sesamoid I: digit 1	**abd brevis pollicis** O: flx retinaculum + trapezium I: digit 1	**abd pollicis brevis** O: transverse carpal ligament + trapezium I: digit 1	**abd pollicis brevis** I: digit 1	**abd pollicis** "well developed"	**abd pollicis brevis** O: flx retinaculum + scaphoid I: digit 1		**abd pollicis brevis** O: flx retinaculum, scaphoid, radial sesamoid I: digit 1
CONTRAHENTES	**add pollicis, contrahens indicis, contrahens digiti quinti** O: MC3 I: digits 1L, 2L, 5M	**add pollicis, contrahentes (u)** O: carpal tunnel I: digits 1L, 2L, 4M, 5M	**add pollicis** O: MC3 I: digits 1L	**contrahentes digitorum** O: capitate + MC4 I: digits 1L, 2L, 4M, 5M	**add pollicis**	**add pollicis, contrahentes** O: carpals I: digits 1L, 2L, 4M, 5M		**add pollicis, contrahentes** O: carpals I: digits 1L, 4M, 5M
FLEXOR BREVES PROFUNDUS	**flx pollicis brevis, flx digiti quinti, palmar and dorsal interossei** 10	**flx pollicis brevis, interossei** ?	**flx pollicis brevis, flx brevis minimi digiti, palmar interossei** 10	**interossei palmares + interossei dorsales** 8	**flx pollicis brevis, flx minimi digiti** 2+	**flx pollicis brevis, flx brevis digiti quinti, interosseous** 9		**flx pollicis brevis, flx brevis minimi digiti, interosseous** 9
INTERMETACARPALES								
? Unknown homology	**opp pollicis** O: trapezium + flx retinaculum I: MC1	**opp pollicis** absent	**opp pollicis** absent	**opp pollicis** I: digit 1	**opp pollicis** "well developed"	**opp pollicis** O: trapezium + flx retinaculum I: MC1		**opp pollicis** O: trapezium + flx retinaculum I: MC1
? Unknown homology		**opp minimi digiti** absent	**opp minimi digiti** absent	**opp digiti minimi** I: digit 5		**opp digiti quinti** O: flx retinaculum I: MC5		**opp minimi digiti** O: flx retinaculum I: digit 5
? Unknown homology					**?flx pollicis brevis** O: palmar fascia I: digit 1; integument radial side palm			
RADIAL SESAMOID "PRE-POLLUX"								
ULNAR SESAMOID								
CARPAL VIBRISSAE								

	Catarrhini continued			
	Hylobatidae	Hominidae		
	Hylobates **Diogo et al., 2012b**	***Homo*** **Standring et al., 2005 (Gray's)**	***Pan*** **Miller, 1952**	***Pongo*** **Primrose, 1899**
PANNICULUS CARNOSUS				
STERNO-FACIALIS				
STERNOMASTOIDEUS		**sternocleidomastoid** O: mastoid I: manubrium + medial clavicle	**sternomastoid** O: mastoid I: manubrium	**sterno-mastoid** O: mastoid + occiput I: manubrium + clavicle
CLEIDOMASTOIDEUS			**cleidomastoid** O: mastoid I: clavicle + sternoclavicular joint	**sterno-mastoid** w/ SM
CLAVOTRAPEZIUS			**sterno-occipital** O: nuchal line I: manubrium	
CEPHALOHUMERALIS				
ACROMIOTRAPEZIUS		**trapezius** O: occiput, ligamentum nuchae, T1-12 I: lateral clavicle, acromion, spine scapula	**trapezius** O: occiput, ligamentum nuchae, T1-9 I: lateral clavicle, acromion, spine scapula	**trapezius** O: occiput, ligamentum nuchae, T1-12 I: lateral clavicle, acromion, spine scapula
DORSO-CUTANEUS				
SPINOTRAPEZIUS				

	Catarrhini continued			
	Hylobatidae	Hominidae		
	Hylobates **Diogo et al., 2012b**	***Homo*** **Standring et al., 2005 (Gray's)**	***Pan*** **Miller, 1952**	***Pongo*** **Primrose, 1899**
RHOMBOIDEUS CAPITIS				
RHOMBOIDEUS CERVICIS		**r. minor** O: ligamentum nuchae, C7-T1 I: spine scapula	**rhomboideus** O: C2-T6 I: deep surface vertebral border scapula	**rhomboideus** O: occiput, ligamentum nuchae, T1-6 I: vertebral border scapula
RHOMBOIDEUS THORACIS		**r. major** O: T2-5 I: vertebral border scapula		
OMOTRANSVERSARIUS "metacromion"			**levator claviculae** O: atlas I: middle clavicle	**omo-cervicalis** O: atlas I: clavicle
OMOTRANSVERSARIUS				
OMOHYOIDEUS		**omohyoid** O: hyoid I: cranial border scapula	**omohyoideus** O: hyoid I: cranial border scapula	**omo-hyoid** "as in man"
SERRATUS VENTRALIS CERVICIS		**levator scapulae** O: C1-4 I: cranial end vertebral border scapula	**levator scapulae** O: C1-3 I: cranial angle scapula	**levator anguli scapulae** O: C1-3 I: cranial angle + vertebral border scapula w/ SVT

	Catarrhini continued			
	Hylobatidae	Hominidae		
	Hylobates **Diogo et al., 2012b**	***Homo*** **Standring et al., 2005 (Gray's)**	***Pan*** **Miller, 1952**	***Pongo*** **Primrose, 1899**
SERRATUS VENTRALIS THORACIS		**serratus anterior** O: ribs 1-8 I: vertebral border scapula	**serratus anterior** O: ribs 1-10 I: cranial angle + vertebral border scapula	**serratus magnus** O: ribs 1-11 I: vertebral border scapula w/ SVC
CLAVODELTOIDEUS				
ACROMIODELTOIDEUS		**deltoid** O: lateral clavicle, acromion, spine scapula I: deltoid tubercle lateral H	**deltoideus** O: lateral clavicle, acromion, spine scapula, fascia IN I: cranio-lateral H	**deltoid** O: lateral clavicle, acromion, spine sapula, fascia IN I: lateral H
SPINODELTOIDEUS				
TERES MINOR		**teres minor** O: caudal border scapula I: distal GT	**teres minor** O: caudal border scapula I: distal GT	**teres minor** "as in man"
SUBSCAPULARIS		**subscapularis** O: subscapular fossa I: LT	**subscapularis** O: subscapular fossa I: LT	**subscapularis** "as in man"
TERES MAJOR		**teres major** O: caudal angle scapula I: medial intertuberous sulcus H	**teres major** O: caudal angle + border scapula I: LT	**teres major** O: caudal border + angle scapula I: H, joined by slip LD
LATISSIMUS DORSI "superficial" "deep"		**latissimus dorsi** O: T6-12, thoracolumbar fascia, iliac crest I: intertuberous sulcus H	**latissimus dorsi** O: T8-12, L, S vertebrae, ilium, ribs 8-12 I: bicipital groove H, slip w/ TMA	**latissimus dorsi** O: T8-12, lumbar aponeuosis I: H, slip w/ TMA

	Catarrhini continued			
	Hylobatidae	Hominidae		
	Hylobates **Diogo et al., 2012b**	***Homo*** **Standring et al., 2005 (Gray's)**	***Pan*** **Miller, 1952**	***Pongo*** **Primrose, 1899**
DORSO-EPITROCHLEARIS		**latissimus dorsi** "fibrous slip from LD tendon to TLO"	**dorsoepitrochlearis** O: LD I: medial condyle	**latissimo-condyloideus** O: LD I: fascia medial epicondyle
PECTORALIS SUPERFICIALIS "clavicular"				**pectoralis major pars clavicularis** absent
PECTORALIS SUPERFICIALIS "superficial"		**pectoralis major** O: medial clavicle, manubrium, sternum, ribs 1-6 I: cranial H	**pectoralis major** O: medial clavicle, sternum, ribs 1-7 I: GHj capsule, GT - middle H	**pectoralis major pars sternalis** O: manubrium I: cranial H
PECTORALIS SUPERFICIALIS "deep"				**pectoralis major pars sterno-costalis** O: ribs 3-6 + sternum I: fascia over biceps tendon
PECTORALIS PROFUNDUS		**pectoralis minor** O: ribs 3-5 I: coracoid process	**pectoralis minor** O: ribs 2-4 I: coracoid process	**pectoralis minor** O: ribs 3-4 I: coracoid + acromion
PECTORALIS ABDOMINALIS			**pectoralis abdominis** O: ribs 8-10, external oblique I: GT	**pectoralis major pars costo-abdominalis** O: rib 5 + external oblique I: GT + fascia over biceps tendon
SUBCLAVIUS		**subclavius** O: ribs 1 I: middle clavicle	**subclavius** O: rib 1 I: middle clavicle	**subclavius** O: rib 1 I: middle clavicle
STERNOSCAPULARIS				

	Catarrhini continued			
	Hylobatidae	**Hominidae**		
	Hylobates **Diogo et al., 2012b**	***Homo*** **Standring et al., 2005 (Gray's)**	***Pan*** **Miller, 1952**	***Pongo*** **Primrose, 1899**
CORACOBRACHIALIS	**coracobrachialis** O: coracoid I: prox H	**coracobrachialis** O: coracoid I: medial H	**coracobrachialis** O: coracoid I: neck + middle H	**coraco-brachialis brevis** O: coracoid I: proximal medial H
CORACOBRACHIALIS	* not pierced by MC			**coraco-brachialis medius** O: coracoid I: middle medial H
BICEPS BRACHII, short head	**biceps brachii** O: prox H + supraglenoid tubercle I: bicipital tuberosity R	**biceps brachii** O: coracoid w/ CB + supraglenoid tuberosity I: R tuberosity	**biceps brachii** O: coracoid + supraglenoid tuberosity I: R tuberosity + lacertus fibrosus	**biceps** O: glenoid + coracoid I: neck R
BICEPS BRACHII, long head	[bicipital aponeurosis partly fleshy and blends			
BRACHIALIS	**brachialis** O: distal 1/2 H I: U tuberosity	**brachialis** O: distal cranial H I: U tuberosity + coronoid process	**brachialis** O: distal cranial H I: coronoid process U	**brachialis** O: cranial H I: coronoid process U, slip to BR
CUBITALIS				
SUPRASPINATUS		**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** O: supraspinous fossa I: GT	**supraspinatus** "as in man"
INFRASPINATUS		**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** O: infraspinous fossa I: GT	**infraspinatus** "as in man"
TRICEPS BRACHII CAPUT LATERALE	**triceps brachii caput laterale** O: lateral prox H I: olecranon	**triceps brachii lateral head** O: proximal caudal H I: olecranon	**triceps brachii** O: H behind GT I: olecranon	**triceps external** O: caudal H I: olecranon

	Catarrhini continued			
	Hylobatidae	Hominidae		
	Hylobates **Diogo et al., 2012b**	***Homo*** **Standring et al., 2005 (Gray's)**	***Pan*** **Miller, 1952**	***Pongo*** **Primrose, 1899**
TRICEPS BRACHII CAPUT MEDIALE	**triceps brachii caput mediale** O: medial distal 1/2 H I: olecranon	**triceps brachii medial head** O: caudal H I: olecranon	**triceps brachii** O: caudo-medial H I: olecranon	**triceps inner** O: caudal H I: olecranon
TRICEPS BRACHII CAPUT LONGUM "tendon portion" (deep)	**triceps brachii caput longum** O: lateral 1/3 border scapula I: olecranon	**triceps brachii long head** O: infraglenoid tubercle I: olecranon	**triceps brachii, long head** O: infraglenoid tuberosity + caudal border scapula I: olecranon	**triceps long** O: caudal border scapula I: olecranon
TRICEPS BRACHII CAPUT LONGUM "fleshy portion" (superficial)				
TRICEPS BRACHII ACCESSORY				
ANCONEUS		**anconeus** O: caudal lateral epicondyle I: lateral olecranon	**anconeus** O: lateral epicondyle I: lateral U	**anconeus** "as in man"
BRACHIORADIALIS		**brachioradialis** O: lateral supracondylar ridge I: styloid process R	**brachioradialis** O: distal lateral H + lateral supracondylar ridge I: lateral R	**supinator longus** O: lateral supracondyloid ridge I: lateral R + styloid process R
EXT CARPI RADIALIS, longus (MC2)		**ext carpi radialis longus** O: lateral supracondylar ridge I: base MC2	**ext carpi radialis longus** O: lateral supracondylar ridge I: base MC2	**ext carpi radialis longior** O: lateral supracondyloid ridge I: base MC2

	Catarrhini continued			
	Hylobatidae	Hominidae		
	Hylobates **Diogo et al., 2012b**	***Homo*** **Standring et al., 2005 (Gray's)**	***Pan*** **Miller, 1952**	***Pongo*** **Primrose, 1899**
EXT CARPI RADIALIS, brevis (MC3)		**ext carpi radialis brevis** O: lateral epicondyle I: base MC3	**ext carpi radialis brevis** O: lateral epicondyle I: base MC3	**ext carpi radialis brevior** O: lateral supracondyloid ridge I: base MC3
EXT DIGITORUM COMMUNIS		**ext digitorum** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext digitorum communis** O: lateral epicondyle I: digits 2, 3, 4, 5	**ext communis digitorum** O: lateral epicondyle I: digits 1, 2, 3, 4
EXT DIGITORUM LATERALIS		**ext digiti minimi** O: lateral epicondyle I: digit 5, (4)	**ext digiti quinti proprius** O: EDC I: digit 5	**ext minimi digiti** O: lateral epicondyle I: digits 4, 5
EXT CARPI ULNARIS		**ext carpi ulnaris** O: lateral epicondyle + U I: base MC5	**ext carpi ulnaris** O: lateral epicondyle I: base MC5	**ext carpi ulnaris** O: lateral epicondyle + U I: lateral MC5
SUPINATOR		**supinator** O: lateral epicondyle + U I: proximal 1/3 R	**supinator** O: lateral epicondyle + proximal 1/4 U I: proximal 1/2 R	**supinator brevis** "as in man"
ABD POLLICIS LONGUS		**abd pollicis longus** O: U + R + interosseus I: base MC1 + trapezium	**abd pollicis longus** O: U + R I: multangular + MC1	**ext ossis metacarpi pollicis** O: R + U I: trapezium (oval sesamoid)
EXT DIGITORUM PROFUNDUS		**ext indicis** O: caudal U I: digit 2	**ext indicis proprius** O: U + R I: digit 2	**ext indicis** O: U I: digits 2, 3
EXT POLLICIS LONGUS		**ext pollicis longus** O: middle U I: digit 1	**ext pollicis longus** O: middle U I: digit 1	**ext longus pollicis** O: U I: digit 1

	Catarrhini continued			
	Hylobatidae	**Hominidae**		
	Hylobates **Diogo et al., 2012b**	***Homo*** **Standring et al., 2005 (Gray's)**	***Pan*** **Miller, 1952**	***Pongo*** **Primrose, 1899**
EXT POLLICIS BREVIS		**ext pollicis brevis** O: caudal R I: digit 1	**ext pollicis brevis** absent	**ext brevis pollicis** O: R + U I: base MC1
EXT BREVIS DIGITORUM				
PRONATOR TERES	**pronator teres** O: H + U I: R	**pronator teres** O: medial epicondyle + coronoid process U I: middle R	**pronator teres** O: medial epicondyle + coronoid process U I: middle 1/3 R	**pronator radii teres** O: medial epicondyle + coronoid process U I: proximal medial R
FLX CARPI RADIALIS	**flx carpi radialis** O: medial epicondyle + ?R I: base MC2, ?base MC3	**flx carpi radialis** O: medial epicondyle I: base MC2, slip to base MC3	**flx carpi radialis** O: medial epicondyle I: base MC2	**flx carpi radialis** O: medial epicondyle + R I: base MC2
PALMARIS LONGUS	**palmaris longus** O: medial epicondyle I: palmar aponeurosis	**palmaris longus** O: medial epicondyle I: palmar aponeurosis	**palmaris longus** O: medial epicondyle I: transverse carpal ligament	**palmaris longus** O: medial epicondyle I: palmar fascia
FLX DIGITORUM SUPERFICIALIS		**flx digitorum superficialis (2 heads)** O: medial epicondyle + coronoid process U // R I: digits 2f, 3f, 4f, 5f O: R	**flx digitorum sublimis** O: medial epicondyle, coronoid process, R, FCR I: digits 2f, 3f, 4f, 5f	**flx sublimis digitorum vel perforatus** O: medial epicondyle + medial olecranon + R I: digits 2, 3, 4, 5
INTERFLEXORII				

	Catarrhini continued			
	Hylobatidae	Hominidae		
	Hylobates **Diogo et al., 2012b**	***Homo*** **Standring et al., 2005 (Gray's)**	***Pan*** **Miller, 1952**	***Pongo*** **Primrose, 1899**
FLX DIGITORUM PROFUNDUS,	**flx digitorum profundus (m+u) + flx pollicis longus**	**flx digitorum profundus + flx pollicis longus**	**flx digitorum profundus**	**flx profundus digitorum vel perforans**
epicondylar				
epicondylar (FDPe)	O: medial epicondyle			
epicondylar (FDPd)				O: cranial U
ulnar	O: U	O: proximal 3/4 U + interosseus membrane	O: U	O: cranio-medial U
radial	O: R	O: R (FPL)	O: R	O: cranial R
	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 1, 2, 3, 4, 5	*I: digits 2, 3, 4, 5
LUMBRICALES	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbricals** O: FDP I: digits 2, 3, 4, 5	**lumbricales** O: FDP I: digits 2, 3, 4, 5	**lumbrical** O: FDP I: digits 2, 3, 4, 5
FLX CARPI ULNARIS, epitrochlear belly	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris** O: medial epicondyle	**flx carpi ulnaris** O: medial epicondyle
ulnar belly	O: U	O: medial olecranon	O: U	O: medial olecranon
	I: pisiform	I: pisiform, MC5	I: base MC5	I: pisiform
EPITROCHLEO-ANCONEUS	**epitrochleoanconeus** absent		**epitrochleo-anconeus** O: medial supracondylar ridge H I: olecranon	
PRONATOR QUADRATUS	**pronator quadratus** O: distal R + U	**pronator quadratus** O: distal R + U	**pronator quadratus** O: distal 1/4 R + U	**pronator quadratus** O: distal 1/4 R + U
PALMARIS BREVIS	**palmaris brevis** ("usually missing") O: pisiform + flx retinaculum I: skin medial palm	**palmaris brevis** O: flx retinaculum + palmar aponeurosis I: skin ulnar side palm	**palmaris brevis** O: transverse carpal ligament I: skin ulnar side palm	

	Catarrhini continued			
	Hylobatidae	Hominidae		
	Hylobates **Diogo et al., 2012b**	***Homo*** **Standring et al., 2005 (Gray's)**	***Pan*** **Miller, 1952**	***Pongo*** **Primrose, 1899**
FLX DIGITORUM BREVIS MANUS	**flx digitorum brevis manus**			
ABD DIGITI MINIMI		**abd digiti minimi** O: pisiform I: digit 5	**abd digiti minimi** O: pisiform I: digit 5	**abd minimi digiti** O: pisiform + annular ligament I: lateral digit 5
ABD POLLICIS BREVIS		**abd pollicis brevis** O: flx retinaculum I: digit 1	**abd pollicis brevis** O: transverse carpal ligament I: digit 1	**abd pollicis** O: trapezium + annular ligament I: digit 1
CONTRAHENTES		**add pollicis** O: capitate, MC2 + 3 I: digit 1 (sesamoid)	**add pollicis, contrahentes** O: carpals I: digits 1L, 4M, 5M	**add obliquus pollicis, add transversus pollicis** O: MC2 + 3 I: digit 1
FLEXOR BREVES PROFUNDUS		**flx pollicis brevis, flx digiti minimi brevis, palmar + dorsal interossei** 10	**flx pollicis brevis, flx digiti quinti, interossei volares and dorsales** 12?	**flx brevis pollicis, flx brevis minimi digiti, palmar and dorsal interossei** 9
INTERMETACARPALES				
? Unknown homology		**opp pollicis** O: trapezium + flx retinaculum I: MC1	**opp pollicis** O: transverse carpal ligament + multangular I: MC1	**opp pollicis** O: trapezium + annular ligament + APL I: MC1
? Unknown homology		**opp minimi digiti** O: hamate + flx retinaculum I: MC5	**opp digiti quinti** O: transverse carpal ligament + hamate I: MC5	**opp minimi digiti** O: unciform I: MC5
? Unknown homology				
RADIAL SESAMOID "PRE-POLLUX"				
ULNAR SESAMOID				
CARPAL VIBRISSAE				

APPENDIX 3 – DATA MATRIX USED FOR PHYLOGENETIC ANALYSIS

	Sternomastoideus	Cleidomastoideus	Clavotrapezius	Brachiocephalicus	Acromiotrapezius origin	Acromiotrapezius inertions	Acromiotrapezius bifid	Spinotrapezius	Dorsocutaneous	Rhomboideus capitis	Rhomboideus cervicis	Rhomboideus thoracis	Omotransversarius	Omohyoideus	Acromiodeltoideus	Spinodeltoideus	Teres minor	Articularis humeri	Subscapularis	Teres major	Latissimus dorsi	Panniculus carnosus	Pectoralis abdominalis	Subclavius	Sternoscapularis	Coracobrachialis	Biceps brachii	Brachialis insertion	Cubitalis	Supraspinatus
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Monotremata	0	0/1	0	0	1	1	0	3	1	1	0	0	2	1	1	0/2	1	?	0	0	0	0	1	3	1	3	0	1	0	0
Didelphimorphia	0	1	1	0	1	1	0	1	?	1	0	0	2	1	1	0	1	0	1	0	2	0	1	1	2	1	0	1	0	0
Paucituberculata	1	1	1	0	1	2	0	3	1	1	1	0	2	1	1	0	1	0	1	1	2	0	1	1	0	1	3	1	0	0
Notoryctemorphia	0	0	1	1	1	1	1	3	?	1	0	0	0	0	3	0	0	0	1	0	2	1	1	2	0	0	6	1	0	0
Dasyuromorphia	0	1	0/1	1	1	1	1	1	?	1	0	0	2	1	2	1	0/1	0	1	1	2	1	1	1/2	0	1/2	0	1	0	0
Diprotodontia	0	1	0/1	0/1	1	1	1	1	?	1	0	0	2	1	2/3	1	1	0	1	1	1/2	0	1	1/2	0	1/2	0	1	0	0
Tubulidentata	0	1	2	0	1	2	0	1	0	1	1	1	1	0	2	0	1	0	1	1	1	0	1	1	1	1	5	1	?	0
Chrysochloridae	0	1	1	0	1	2	1	3	0	1	1	1	2	0	2	0	0	0	1	0/1	0	0	1	1	1	0	5	1	1	0
Tenrecidae	0	2	1/2	0/4	1	2	0	3	1	1	0	1	1	1	2	0	1	0	1	0/1	1	0	1	0	1	1/2	2/5	1	1	0
Macroscelidea	0	1/2	1	0	0/1	2	1	3	1	1	2	1	1	0	2	1	1	0	1	0/1	2	0/1	1	1	1/2	1	0	1	?	0
Hyracoidea	2	2	1	4	0/1	4	0	2	0	1	2	1	2	0	3	1	1	0	1	1	1	1	1	0	1	1	4	1	1	0
Proboscidea	2	2	1	4	0/1	2	0	1	?	0	0	1	2	0	3	0	1	0	1	0	1	0	0	0	0	1	4/5	1	1	0
Sirenia	2	2	1	4	1	2/4	0	1	?	0	0	1	2	0	3	0	0	0	1	1	1	0	0	0	0	1	5	2	1	0
Pilosa	0	1	0	0	0	1	0	1	0	0	2	0	0	0	2	0	0/1	0	1	0	1/2	1	0	2	0	0/1	9	1	0	0
Cingulata	0	1	1	0	0	1	0	2	0	1	2	0	?	0	2	0/2	0/1	0	1	0	0	1	1	2	1	1/2	2/4	1	0	0
Erinaceidae	0	1	1	0	1	2	0	3	1	1	0	1	1	1	2	0	0/1	0	1	1	2	0	1	1	0/1	0/1	4	2	0	0
Soricidae	0	1	1	0	1	3	1	3	?	1	2	1	1	1	2	0	0/1	0	1/2	0	2	0	0	1	0	0/1	2	2	0	0
Solenodontidae	0	1	1	0	1	2	0	3	?	1	1	1	1	0	2	0	1	0	1	0	2	0	1	1	0	2	1	2	0	0
Talpidae	1	1	1	0	0/1	3	1	3	1	1	2	1	0	0	2	0	0	0	2	1	1/2	0	1	2	1	0	5	1	0	0
Chiroptera	0	1	0/1	0	0	1	0	2	1	0	0	1	1	0	2	2	1	0	1	0/1	2	2	1	1	0	1	6	1	0	0
Perissodactyla	2	1/2	1	2/5	0	4	0	1	0	0	2	1	1	1	0	1	1	1	1	1	2	0/1	1	0	1	1/2	7	2	0	1
Pholidota	?	?	1	?	1	4	0	1	0	1	3	1	1	0	0	0	1	0	1	1	2	0	1	?	?	0	4	1	0	0
Felidae	0	1	1	3	0	4	0	2	0	1	2	1	1	0	2	1	1	1	1	1	1	2	1	0	0	1	5	1	0	0
Viverridae	0	1	1	3	0	4	0	2	0	0	2	0	1	0	2	1	1	0	1	1	2	2	1	1	0	1	5	1	0	0
Hyaenidae	1	1	1	3	0	4	0	2	0	0	2	0	1	0	2	1	1	0	1	1	1	2	1	0	0	1	2	1	0	0
Canidae	1	1	1	3	0	4	0	2	0	1	2	1	1	0	2	0	1	0	2	1	1	2	1	0	0	1	2	1	0	0
Ursidae	0	1	1	?	0	4	0	2	0	1	1	0	1	1	2	1	1	1	2	1	1	2	1	0	0	2	5	1	0	0
Ailuridae	1	1	1	3	0	4	0	2	0	0	2	1	1	0	2	1	1	1	1	1	1	2	1	0	0	2	6	1	0	0
Mustelidae	1	1	1	3	0	4	0	2	0	1	2	0	2	1	2	0	1	0	1/2	1	1	1/2	0	0	0	2	5/7	1	0	0
Procyonidae	0	1	1	3	0/1	4	0	2	0	1	2	?	1	0	2	1	1	0	2	1	1	2	1	0	0	1	?	1	0	0
Odobenidae	0	1	1	3	?	4	0	2	0	1	0	1	2	0	0	0	1	0	2	0	?	1	0	0	0	1	5	2	0	1
Otariidae	0	1	1	3	0	4	0	2	0	1	0	1	2	1	0	0	1	0	2	0/1	?	0	0	0	0	0	5	1	0	1
Phocidae	0	0	1	2	0	4	0	2	0	1	0	1	2	0	0	0	1	0	2	0/1	?	1	1	1	0	0	5	1	0	1
Camelidae	0	1	1	3	0	4	0	1	0	0	2	1	1	1	2	1	1	1	?	1	2	2	0	0	1	1	5	2	0	1
Tayassuidae	0	1	1	3	1	4	0	2	0	1	2	1	1	1	0	1	1	1	1	1	2	1	0	0	1	2	6	2	0	0/1
Suidae	0	1	1	3	1	4	0	2	0	1	2	1	1	1	0	1	1	1	2	1	2	1	0	0	1	2	6	2	0	1
Tragulidae	0	1	1	3	1	4	0	1	0	1	2	1	1	1	2	1	1	0	1	1	2	1	0	0	1	2	5	1	0	0/1
Giraffidae	2	1	1	3	0	4	0	1	0	0	2	0	1	2	0	1	1	0	?	1	2	2	0	?	?	2	6	1	0	1
Bovidae	2	1	1	3	0	4	0	1	0	0	2	1	1	2	2	0	1	0	2	1	2	2	0	0	1	1	6	2	0	1
Hippopotamidae	2	1	1	3	0/1	4	0	1	0	0	2	1	1	2	2	1	1	0	2	1	2	2	0	0	1	1	6	2	0	1
Cetacea	0	0	2	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	1	0	2	1	0	0	0	1	8	0	0	0
Lagomorpha	0	1	1	0	1	2/4	0	1	0	1	?	?	1	?	2	1	1	0	1	1	1	0	0	?	?	1	2	?	0	0
Rodentia	0	1	1	0	1	1/2	0	1/2	1	1	2	0/1	1/2	1	1/2	0/1	1	0	1	0/1	1/2	0/1	1	1	0/2	1/2	1/6/9	1	0	0
Dermoptera	0	1	0	0	0	2	0	?	0	1	?	?	1	0	2	0	1	0	1	?	1	?	?	1	0	2	6	1	0	0
Scandentia	0	1	1	0	1	2/4	0	1	0	1	2	0	2	1	2	0	?	0	1	0	0	0/1	1	1	0	2	6	1	0	0
Primates	0	1	0	0	0/1	1/2	0	1	0	1	2	0	1/2	1	2	0	1	0	1	0/1	1/2	0/1/2	1	1	0	1/2	6	1	0	0

	Dorso-epitrochlearis	Triceps brachii	Anconeus	Brachioradialis	Ext carpi radialis	Ext digitorum communis	Ext carpi ulnaris	Supinator	Ext digitorum profundus	Ext brevis digitorum	Pronator teres	Palmaris longus	Flx digitorum superficialis	Interflexorius	FDP - humeral heads	FDP - radial head	Flx carpi ulnaris	Epitrochleo-anconeus	Pronator quadratus	Palmaris brevis	FBM - digit 1	FBM - digit 2	FBM - digit IV	FBM - digit V	Lumbricales	Contrahens - digit I	Contrahens - digit II	Contrahens - digit IV	Contrahens - digit V	Intermetacarpales
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Monotremata	1/2	0	2	1	1	0/1	1	1	0/1	0	1	0	0/1	0	2/3	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0
Didelphimorphia	1	0	2	2	1	0	1	1	1	0	1	1	1/2	0	2	1	0	1	1	0/1	0	0	0	0	2	1	1	1	1	1
Paucituberculata	1	0	?	1	1	0	1	1	1	0	1	1	1	0	2	1	0	1	0	0	0	0	0	0	2	0	1	1	1	1
Notoryctemorphia	1	0	2	0	3	0	2	1	1	0	1	0	0	0	2	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Dasyuromorphia	1	1	1	2	2/3	0	2	1	1/2	0	1	1	1/2	0	1/2	1	0	1	1	1	0	0	0	0	2	1	1	1	1	1
Diprotodontia	1	0	1	2	1/2	0/1	1/2	1	0/1/2	0	1/2	2	1	0	1	1	0	1	1	1	0	0	0	0	2	1	1	1	1	1
Tubulidentata	2	1	2	2	2	0	2	1	1	0	2	1	0/1	0	2	1	1	1	1	0	0	0	0	0	2	0	1	0	1	?
Chrysochloridae	2	1	2	0	3	0	2	1	1	0	2	2	0	0	2	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0
Tenrecidae	1	1	2	0	1/2	0	2	1	1	0	1	1	1/2	1	2	0/1	0/1	1	1	1	0/1	0/1	1	1	2	1	0/1	0	1	0
Macroscelidea	1/2	1	2	0	4	0	1/2	1	1	0	1	1	2	1	2	0	0	1	1	1	0	0	0	1	2	0/1	1	0/1	1	0
Hyracoidea	2	1	2	0	2	0	2	0/1	0	0	1	2	1	1	2	0	0	0	0	0	1	1	1	1	1	0	1	1	1	?
Proboscidea	2	0	2	2	2/4	0	2	0	1	0	0	2	0	0	2	0	0	0	0	1	0	0	1	1	1	0	1	1	1	?
Sirenia	0	0	0	2	2	0	1	0	1	0	0	1/2	1	0	0/1	0	2	0	0	0	0	0	0	1	1	0	1	1	1	0
Pilosa	1	0	2	1	2/3	0	1	1	1	1	2	1/2	1	0	1	1	0	1	1	0	1	0	1	1	0/1	1	1	1	0	0
Cingulata	1/2	1	1/2	0	2	0	2	1	1	1	2	2	0	0	0/2	1	0/1	1	0	0	0	1	0	0	1	1	1	1	0	0
Erinaceidae	1	0	2	0	2	0	1	1	1	0	1	2	2	0	3	1	0	1	1	1	0/1	0	0	1	0/2	0	0	0	0	?
Soricidae	1	1	0/2	0	2	0/1	2	1	1	0	1	2	2	0	3	1	0/1	1	1	0	0	0	0	1	0	0	0	0	0	0
Solenodontidae	2	2	2	0	2	0	2	1	1	0	1	2	2	0	3	1	2	1	0	0	0	0	0	0	2	1	1	0	1	0
Talpidae	1	1/2	2	0	2/3	1	1	1	1	0	2	2	2	0	1	0/1	0/1	1	0	0	0	0	0	0	0	0	0	0	0	0
Chiroptera	0	1	0	1	0	0	2	1	2	0	1	2	0	0	1	0/1	0/1/2	0	0	0	0	0	0	0	0	1	1	0	0	?
Perissodactyla	1/2	1	2	1	3	0	2	0	0	0	0/1	0	1/2	0	1/2	1	0/2	0	0	0	0	0	0	1	0/1	0	1	1	1	0
Pholidota	1	1	2	1	3	0	1	2	1	1	2	2	1	0	1	1	0	1	0	0	0	0	0	1	2	1	1	1	1	0
Felidae	1	2	2	1	1	0	2	2	1	0	1	2	1	1	3	1	0	0	1	1	0	0	1	1	2	1	1	0	1	0
Viverridae	1	0	2	1	1	0	2	2	1	0	1	2	1	0	2/3	1	0	0	1	0	0	0	0	1	2	1	1	0	1	0
Hyaenidae	1	2	2	0	1	0	2	2	1	0	1	2	1	0	1	0	2	0	1	0	0	0	0	1	1/2	0	1	0	1	0
Canidae	1/2	2	2	1	1/2	0	2	2	1	0	1	2	1	0	3	1	0	0	1	0	0	0	0	1	1	1	1	0	1	0
Ursidae	2	1	2	1	1	0	2	2	1	0	1	2	1	0	3	1	0	1	1	1	0	0	0	0/1	2	1	1	0	1	0
Ailuridae	2	2	2	1	1	0	2	2	1	0	1	2	1	0	3	1	0	1	1	1	0	0	0	1	2	1	1	0	1	0
Mustelidae	2	1	2	1	1/2	0	2	2	1	0	1	2	1	0	3	1	0/1	1	1	0	0	0	0	1	2	1	1	0	1	0
Procyonidae	1/2	2	2	1	1	0	2	2	1	0	1	2	1	1	2	1	0	1	1	1	0	0	0	1	1	1	1	1	1	0
Odobenidae	2	2	2	1	2	0	?	2	1	0	1	?	1	0	1	1	0	1	1	1	0	1	1	0	1	0	0	1	0	0
Otariidae	2	1	2	1	2	0	3	2	1	0	1	1/2	?	0	1/2	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0
Phocidae	2	1	2	1	2	0	1/2	2	1	0	1	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0
Camelidae	0	0	1	0	3	0	2	0	?	0	0	0	?	0	2	1	0	0	0	0	0	0	0	0	0	0	?	?	?	0
Tayassuidae	1	0	1	0	3	1	2	0	1	0	0	1/2	1	1	2	1	2	0	0	0	0	0	0	0	1	0	1	0	1	0
Suidae	2	1	1	0	3	1	2	0	1	0	0	2	1/2	1	2	1	2	0	0	0	0	0	0	0	1	0	1	0	1	0
Tragulidae	2	1	1	0	3	1	2	0	1	0	0	2	2	0	2	1	0	0	0	0	0	0	0	0	1	0	1	0	1	0
Giraffidae	?	0	?	0	3	0	2	0	?	0	0	?	?	0	1	1	?	0	0	0	0	0	0	0	0	0	?	?	?	0
Bovidae	2	2	1	0	3	0	2	0	1	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Hippopotamidae	1	1	1	0	3	0	2	0	0	0	1	1	2	1	2	0/1	0	0	0	0	0	0	1	1	1	0	1	0	1	0
Cetacea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/1	0/1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagomorpha	2	0	0	0	1	0	1	0	2	0	1	2	2	?	2	1	0	1	0	?	0	0	0	?	2	0	1	1	1	0
Rodentia	1/2	2	0/1	0/1	1	0/1	1/2	1/2	1/2	0	1	1/2	2	0	2	1	0/1	1	1	1	0	0	0	0/1	1/2	1	1	0	1	0
Dermoptera	2	0	1	1	1	0	2	2	2	0	1	2	?	1	0	1	0	1	1	1	0	0	0	1	2	1	1	0	1	0
Scandentia	2	2	1	0/1	1	0/1	2	1	2	0	1	2	2	1	2	1	0	1	1	1	0	0	0	1	2	1	1	0	1	0
Primates	1	0	1	1	1	0	1/2	2	2	0	1	2	2	1	0/1/2	0/1	0	0/1	1	1	0	0	0	0	2	1	1	1	1	0

APPENDIX 4 – IMAGES FOR THE TRAPEZIUS COMPLEX

The variation for each muscle of the trapezius complex in each order is best depicted in illustration. In the figures, the trapezius complex is colored pink, the portions of mm. deltoideus are colored orange, and mm. omotransversarius colored blue.

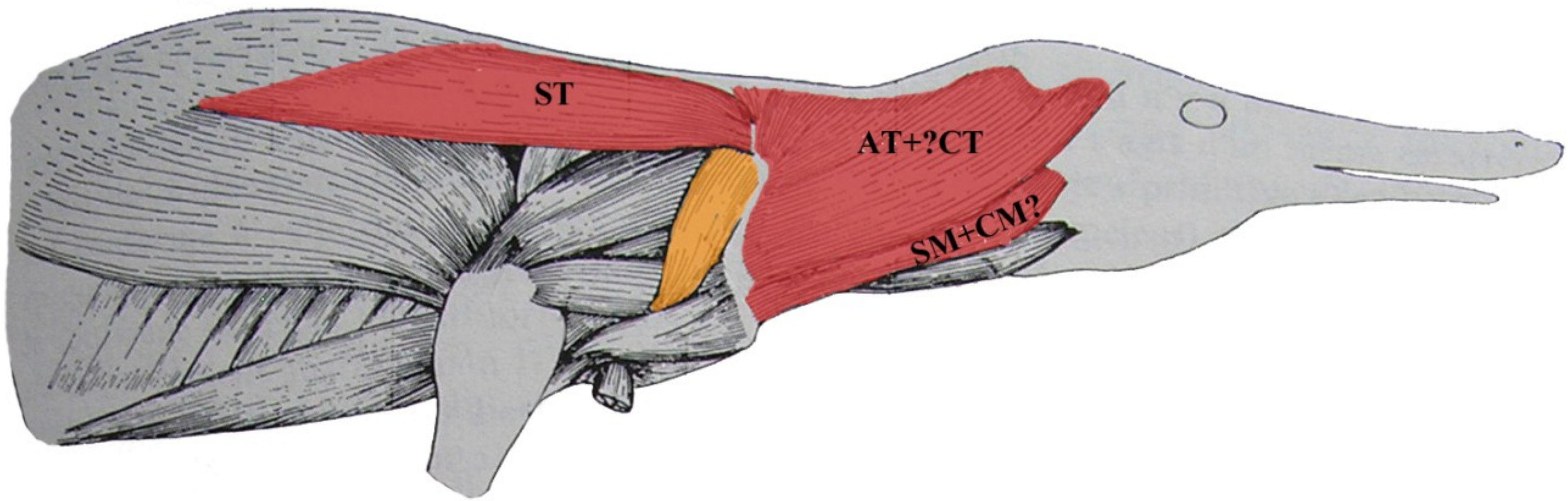


Figure A4-1. *Ornithorhynchus* trapezius complex (modified from Jouffroy, 1971: fig. 623, after Cuvier & Laurillard, 1850)

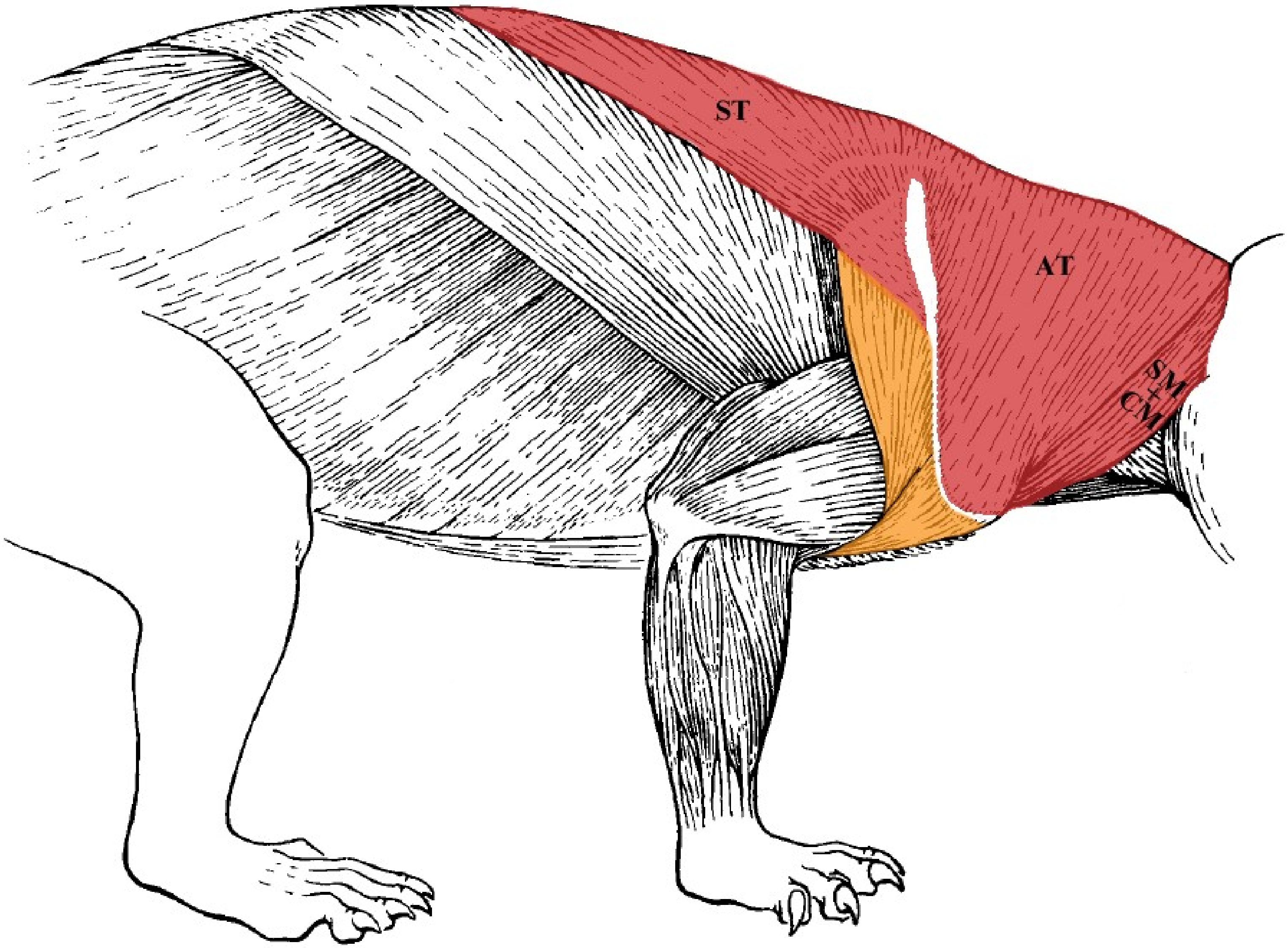
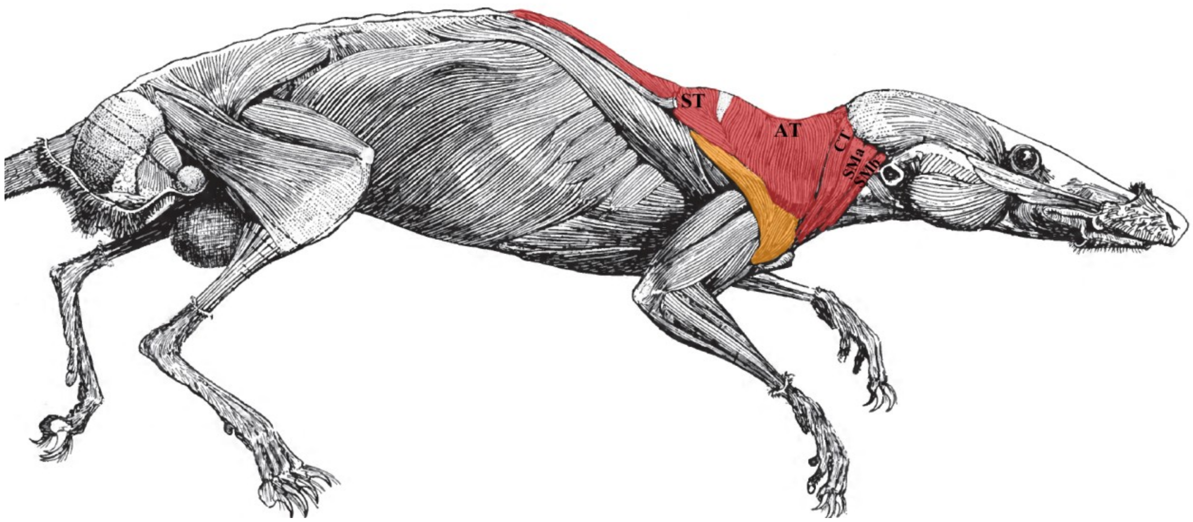


Figure A4-2. *Didelphis* trapezius complex (modified from Jenkins & Weijs, 1979)

A.



B.

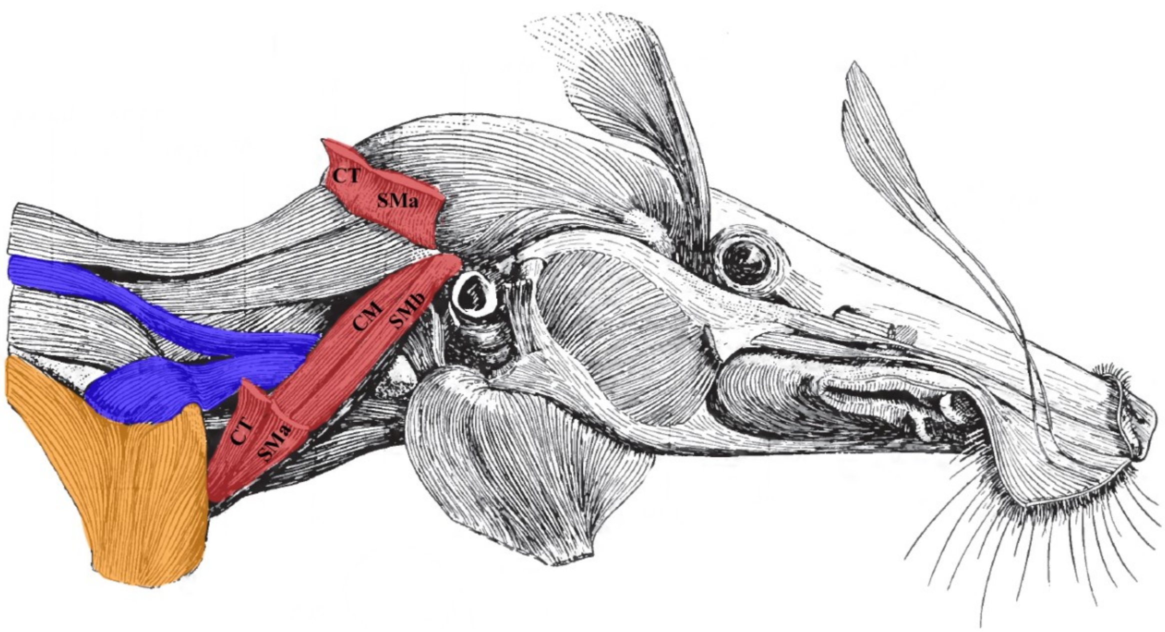
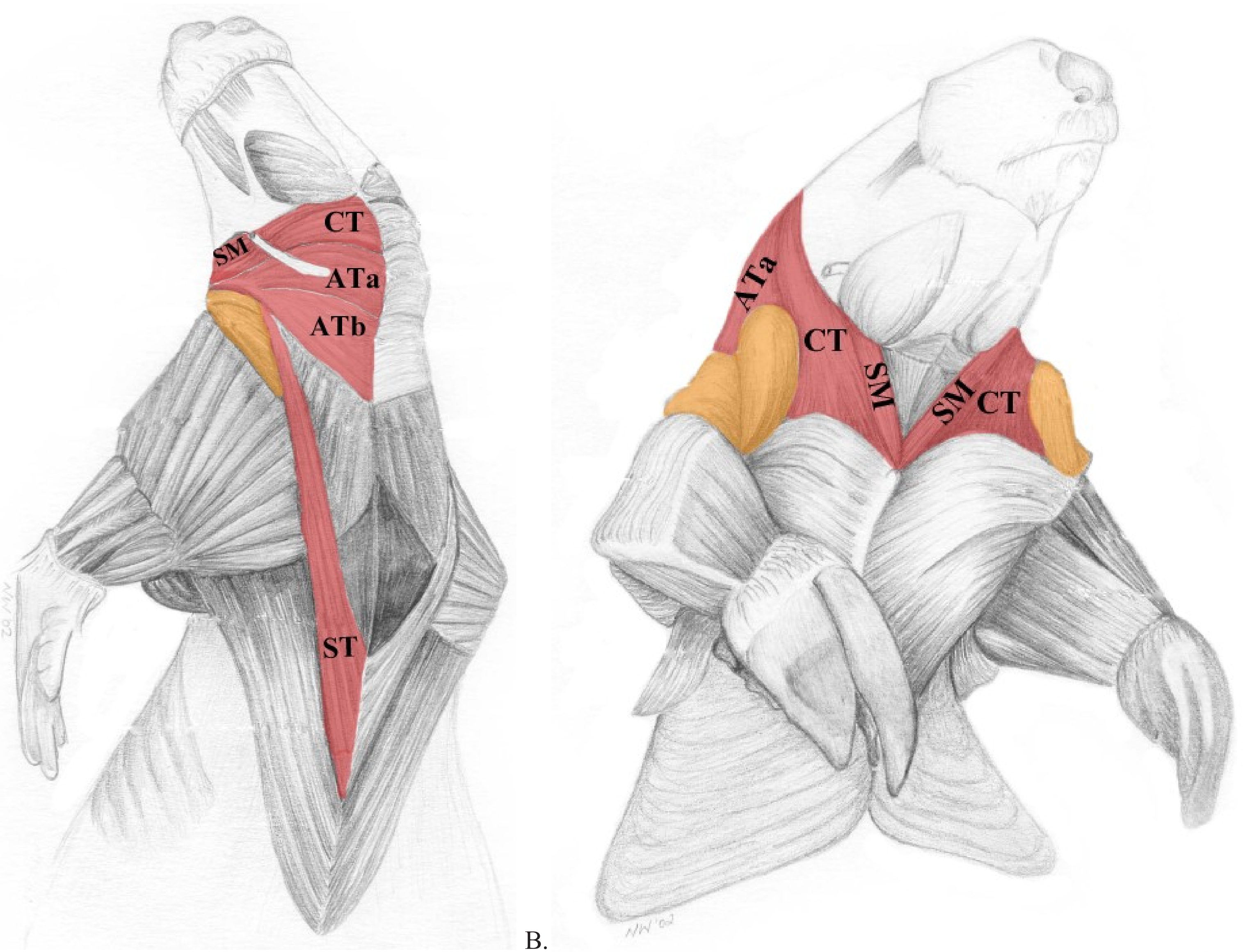


Figure A4-3. *Caenolestes* trapezius complex (modified from Osgood, 1921)

A. Superficial view of trapezius complex. B. Deep view of trapezius complex.



A. B.

Figure A4-44. *Notoryctes* trapezius complex (modified from Warburton, 2003)
A. Dorsal view. B. Ventral view.

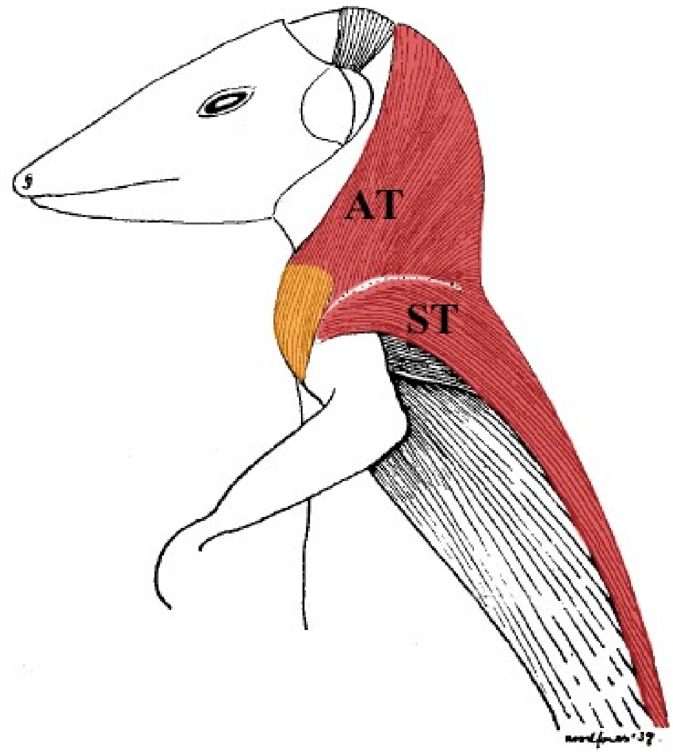


Figure A4-5. *Dasycercus* trapezius complex (modified from Jones, 1949)

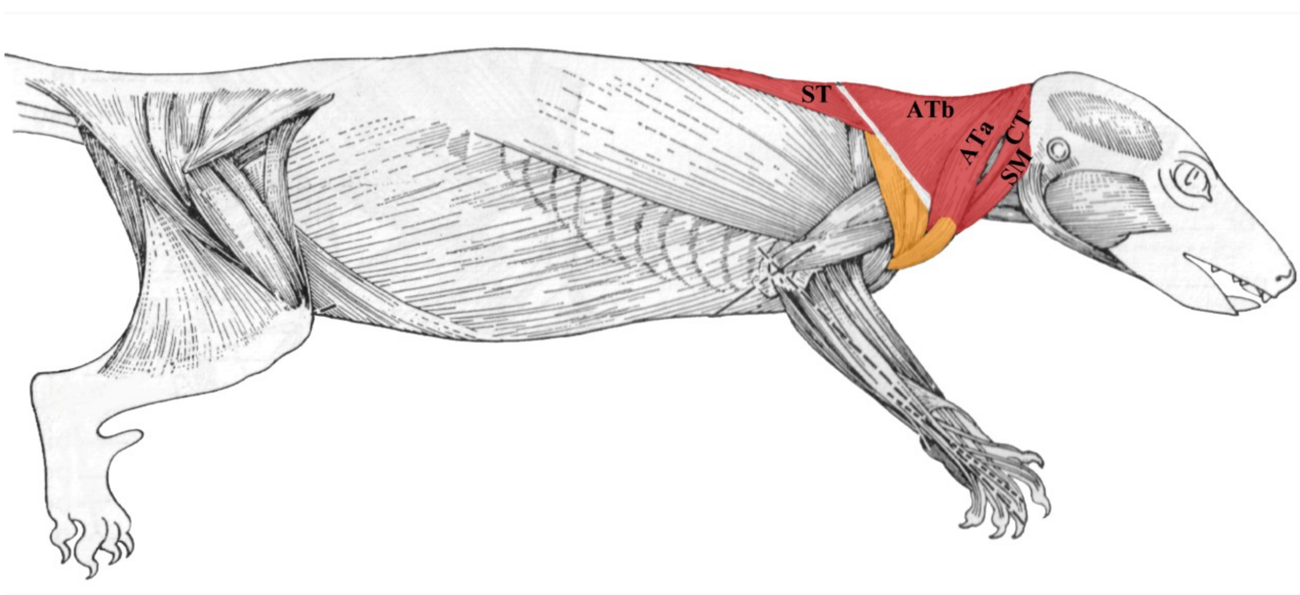


Figure A4-6. *Phalanger* trapezius complex (modified from Jouffroy, 1971, after Cuvier & Laurillard, 1850)

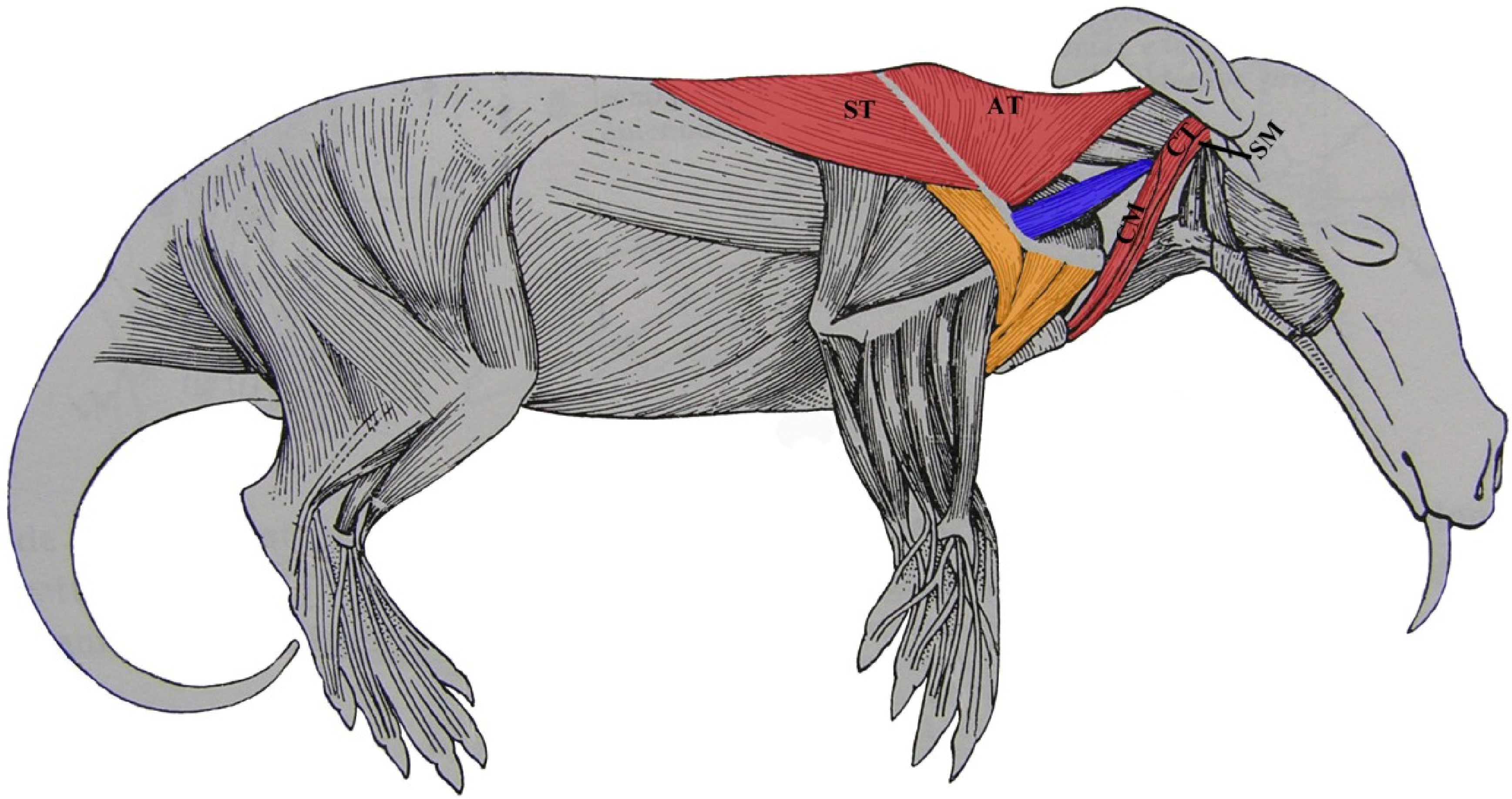


Figure A4-7. *Orycteropus* trapezius complex (modified from Jouffroy, 1971, after Cuvier & Laurillard, 1850)

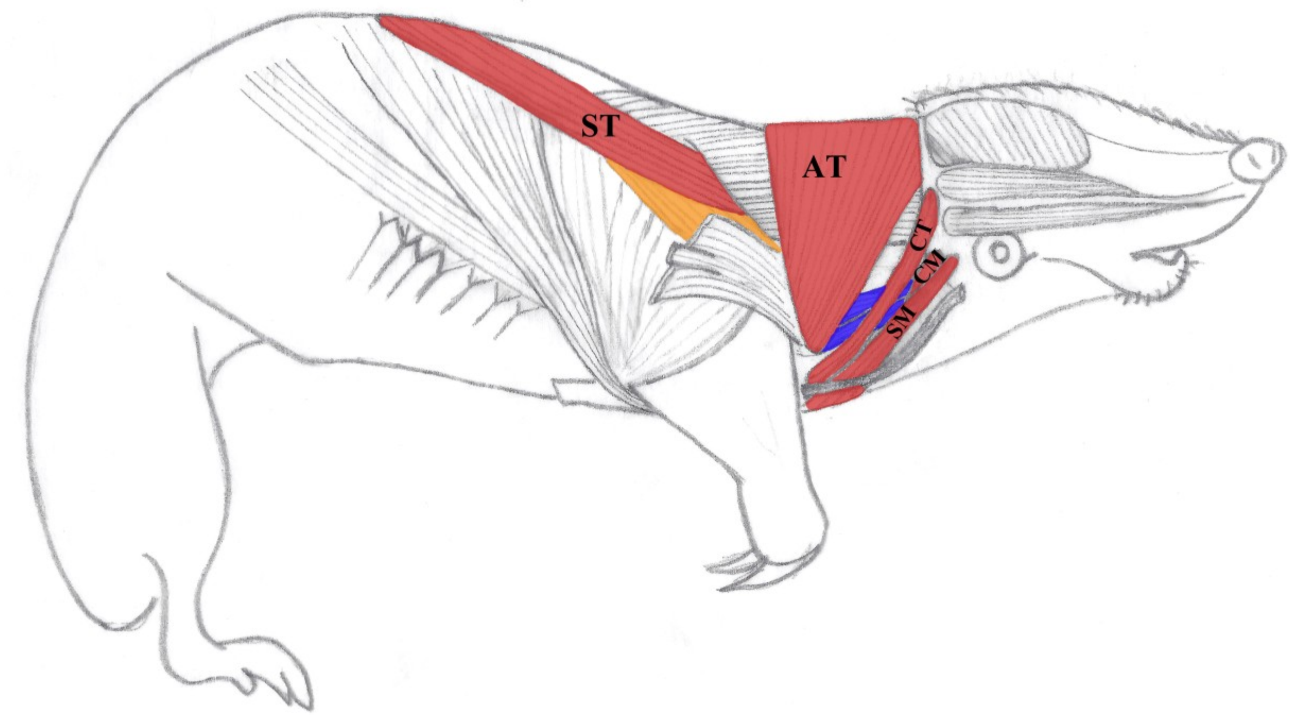


Figure A4-8. *Calcochloris* trapezius complex

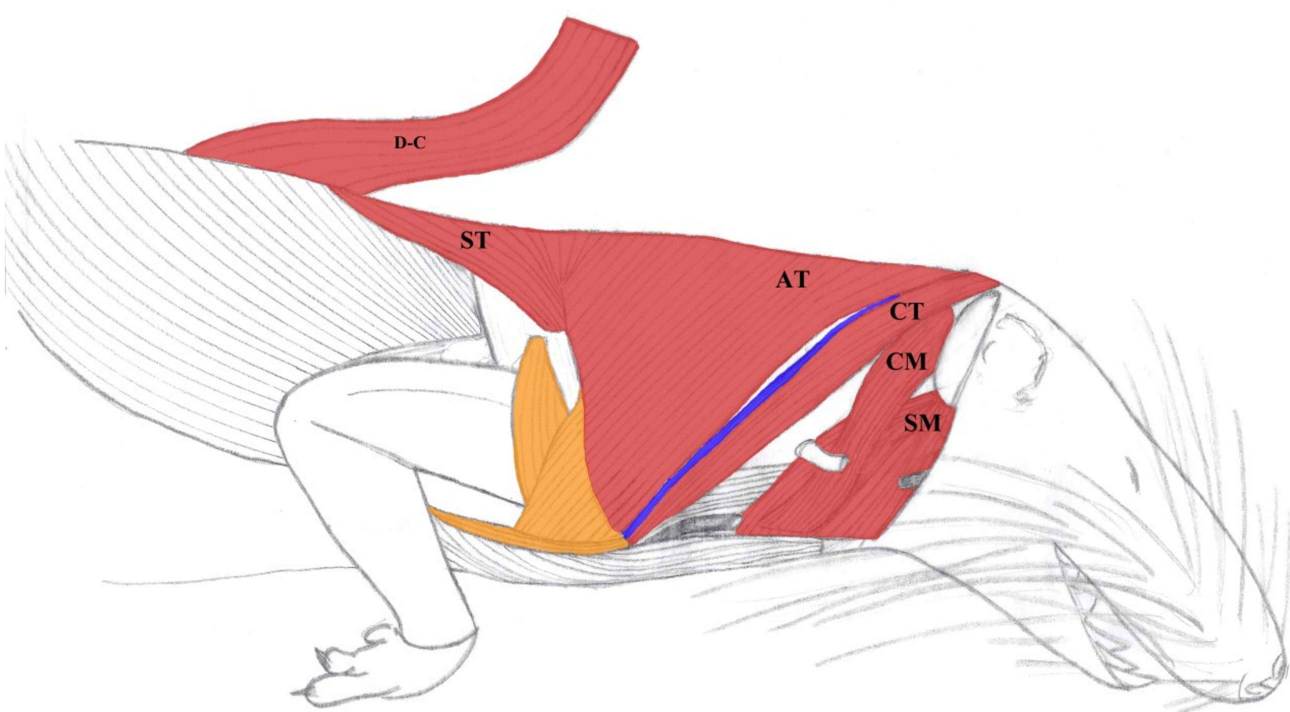
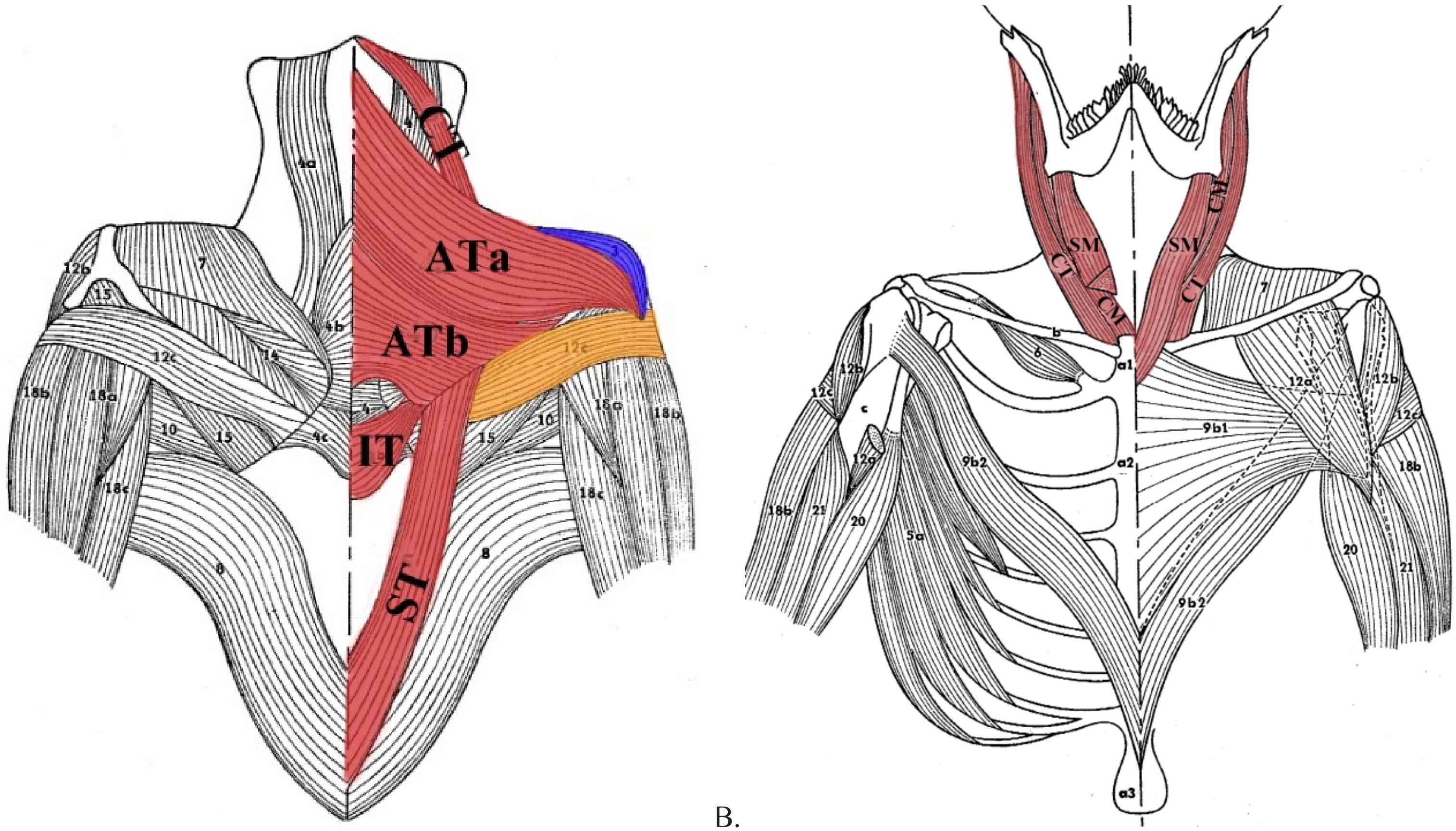


Figure A4-9. *Potamogale* trapezius complex



A B.

Figure A4-10. *Elephantulus* trapezius complex (modified from Jullien, 1967)

A. Dorsal view. B. Ventral view.

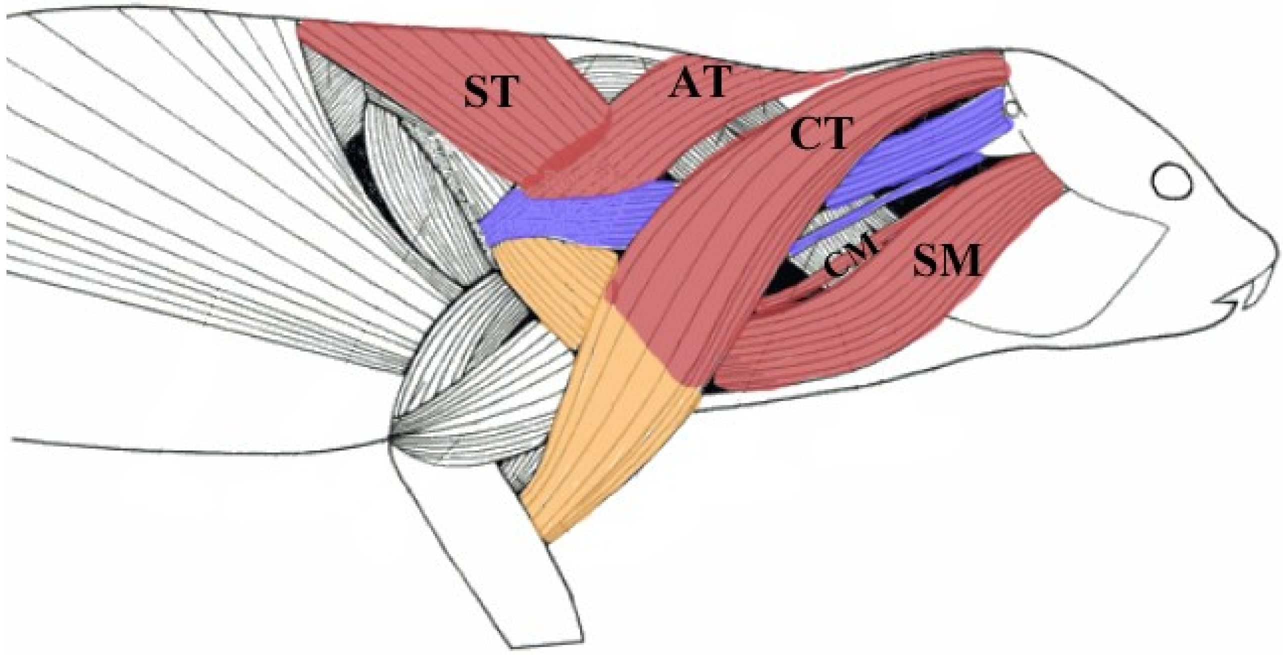


Figure A4-11. *Procavia* trapezius complex (modified from Fischer, 1986)

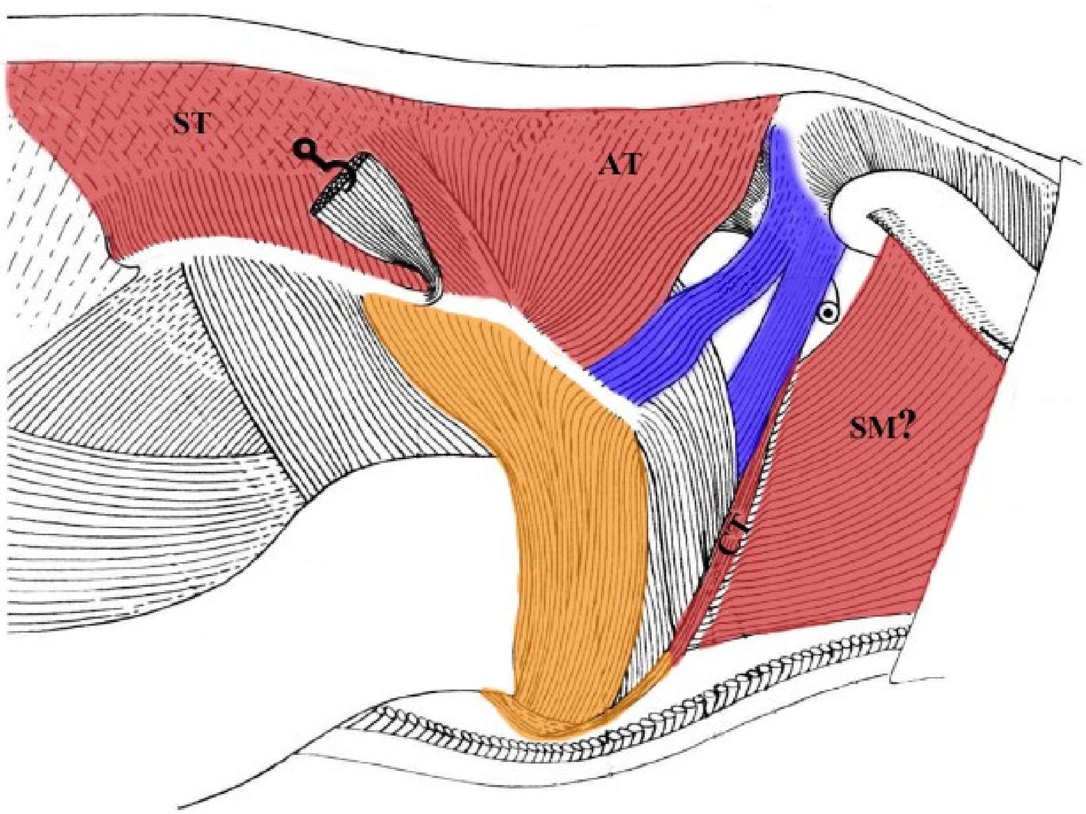


Figure A4-12. *Dugong* trapezius complex (modified from Domning, 1977)

Figure A4-13. *Bradypus* trapezius complex (modified from Jouffroy, 1971, after Cuvier & Laurillard, 1850)

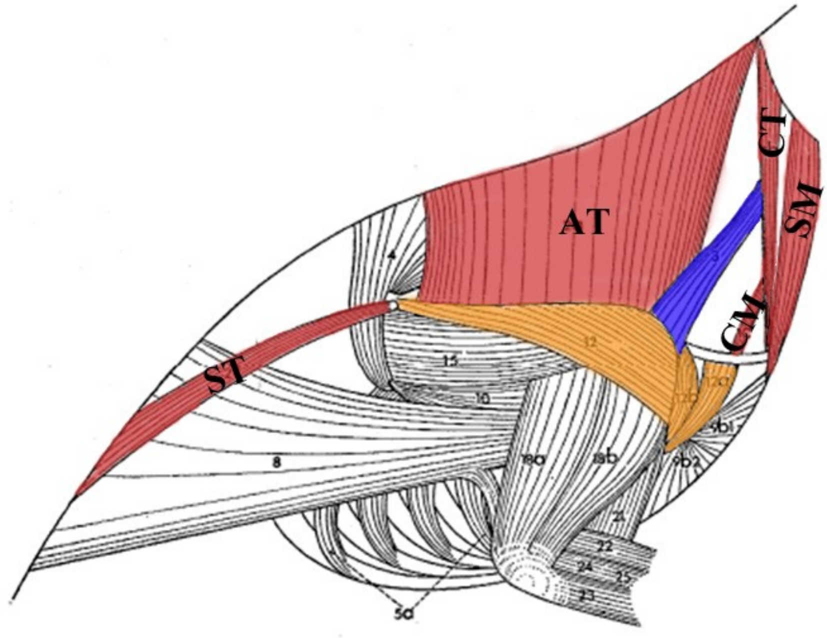


Figure A4-14. *Erinaceus* trapezius complex (modified from Jullien, 1967)

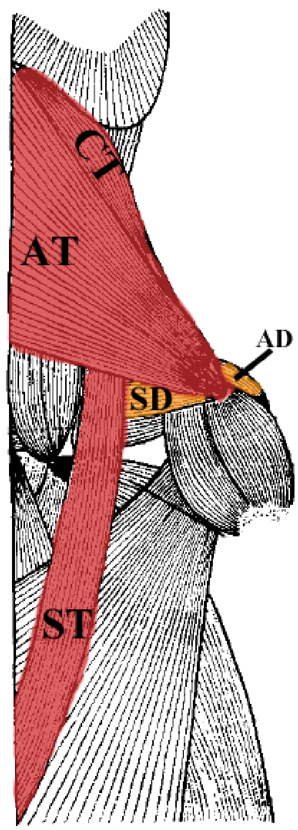
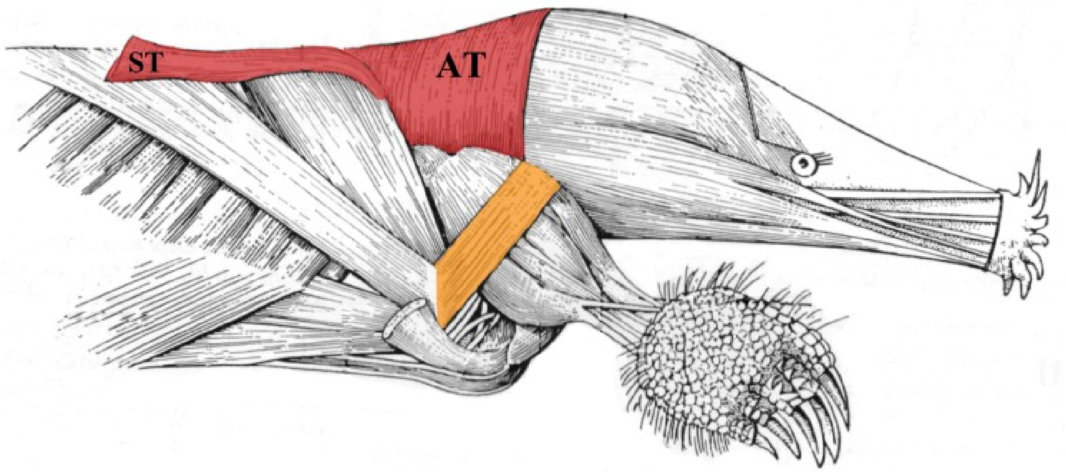
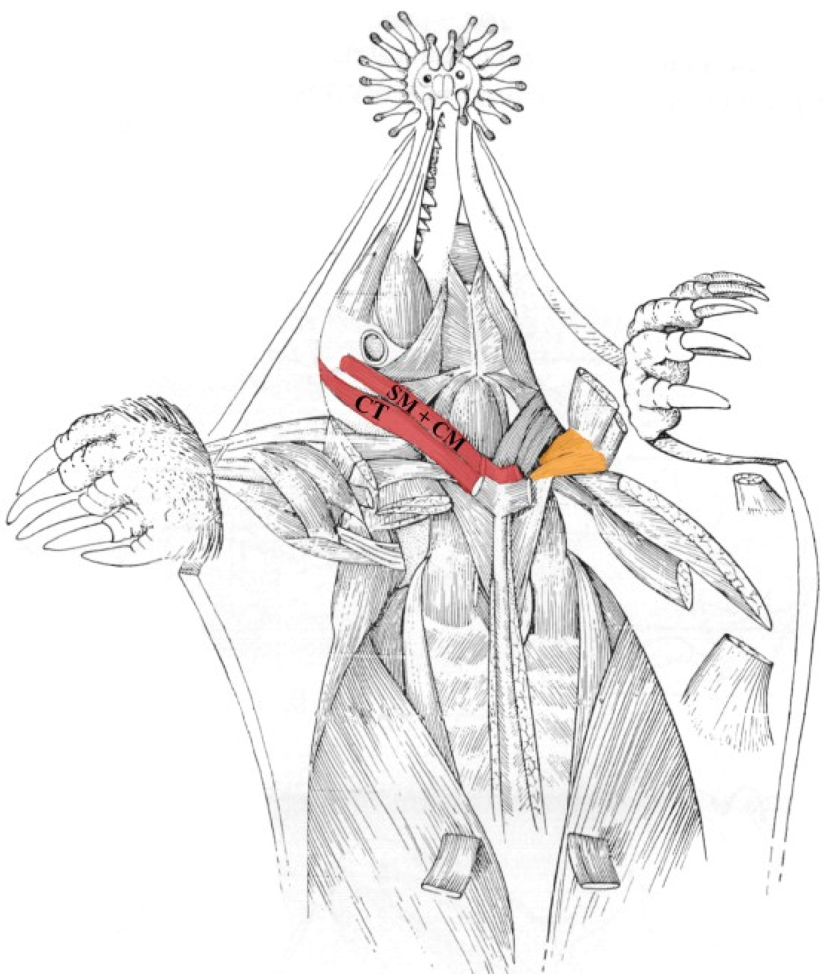


Figure A4-15. *Suncus* trapezius complex, dorsal view (modified from Sharma, 1958)



A.



B.
Figure A4-16. *Condylura* trapezius complex (modified from Jouffroy, 1971, after Dobson, 1883)
A. Lateral view. B. Ventral view.

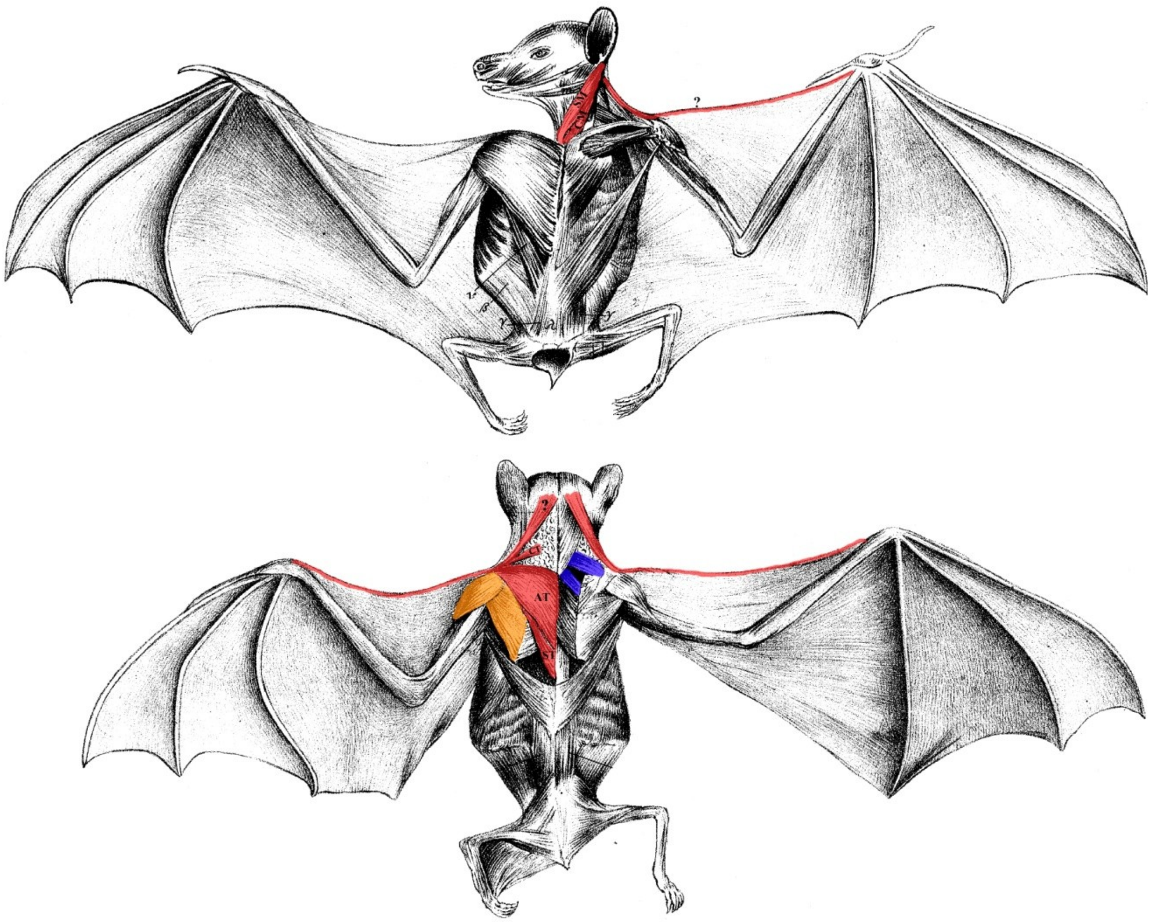


Figure A4-17. *Nyctimene* trapezius complex (modified from Macalister, 1872: plate XV)

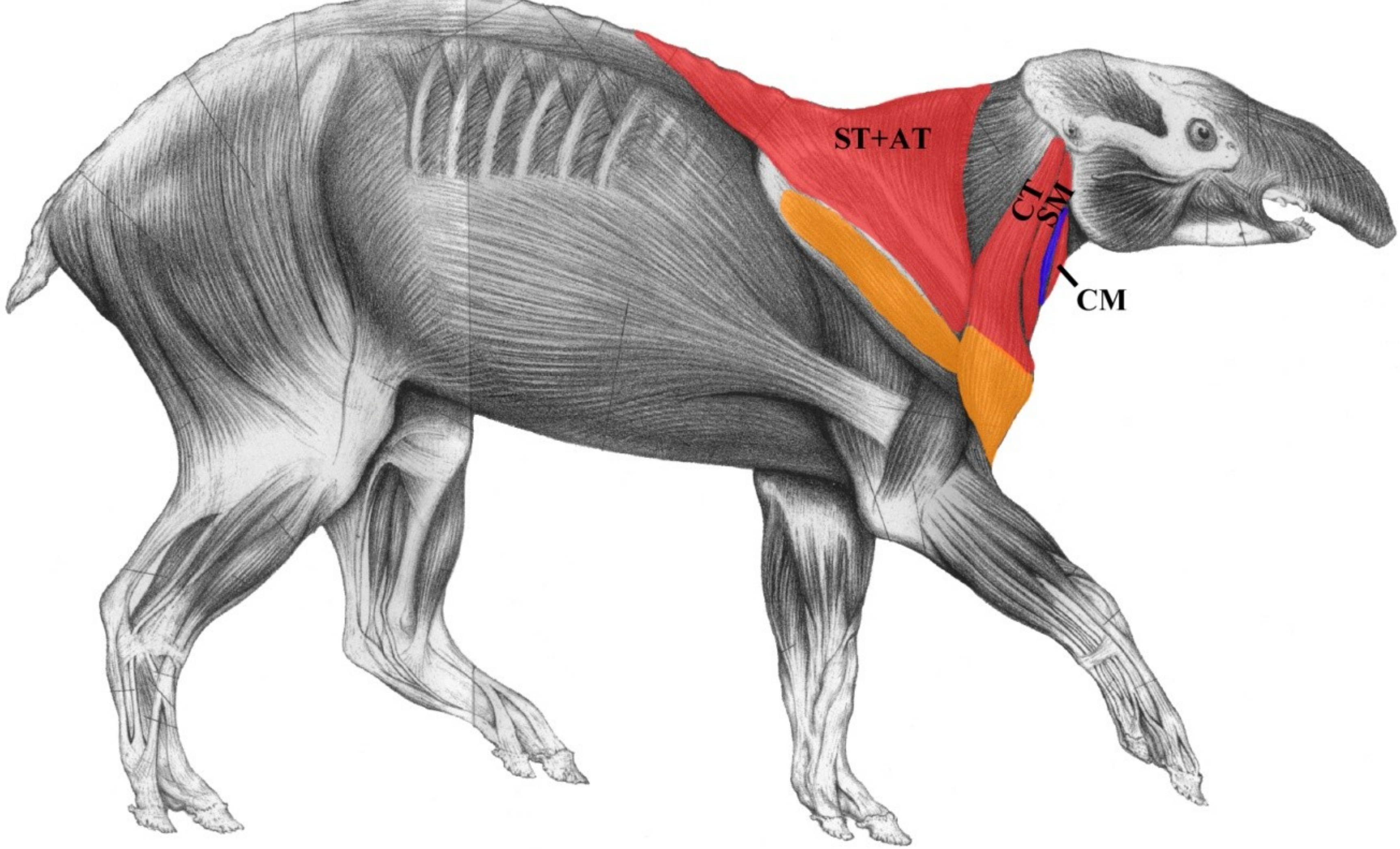


Figure A4-18. *Tapirus* trapezius complex (modified from Murie, 1871)

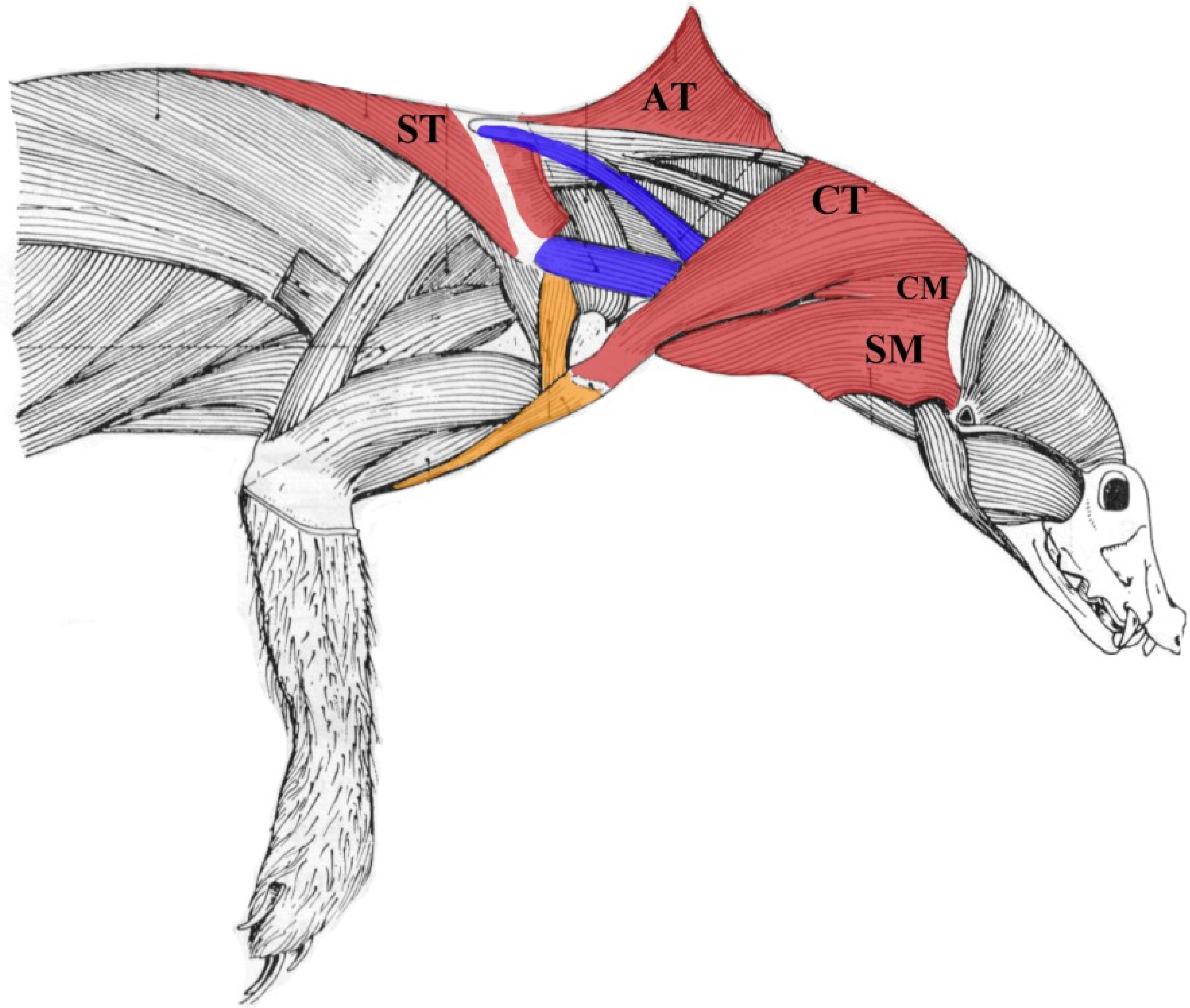


Figure A4-19. *Mustela* trapezius complex (modified from Jouffroy, 1971)

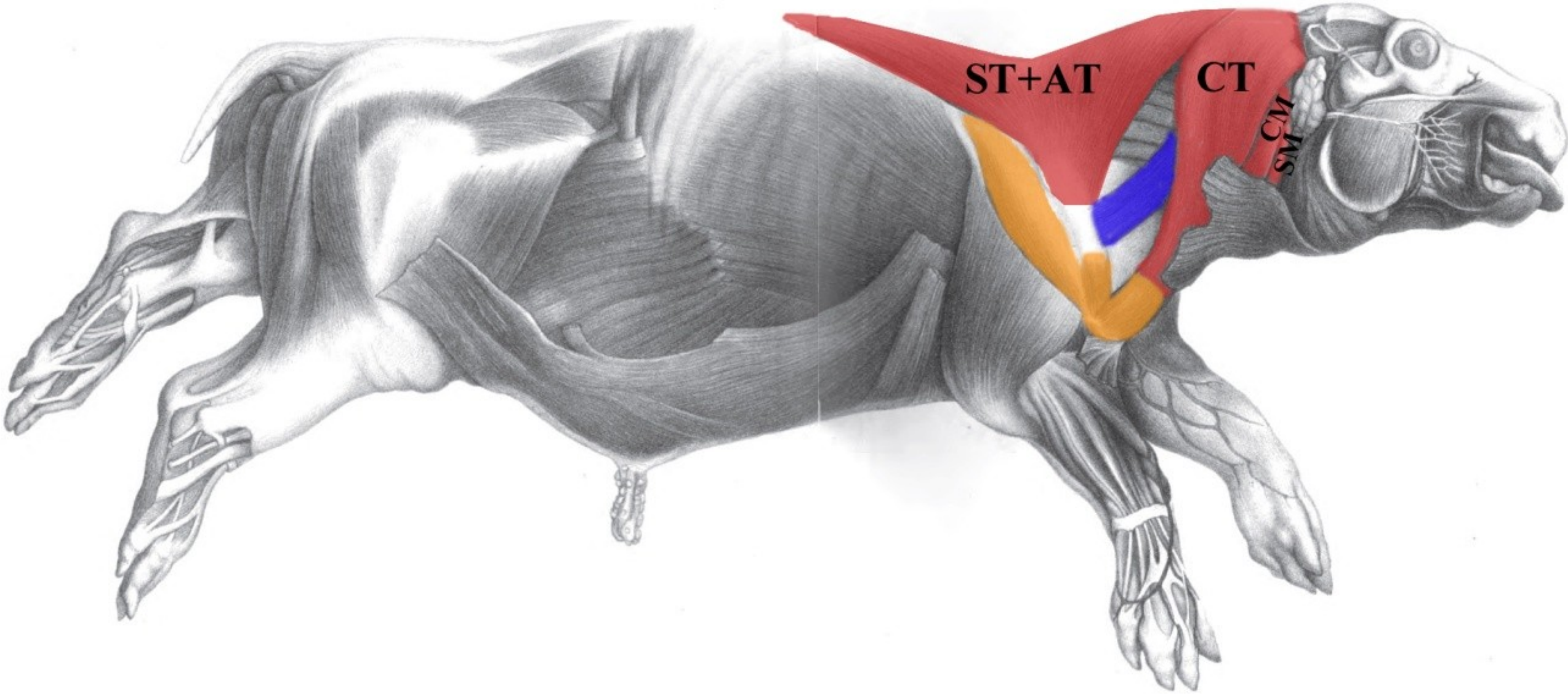


Figure A4-20. *Hippopotamus* trapezius complex (modified from Gratiolet, 1867)

Figure A4-21. *Globicephala* trapezius complex (modified from Murie, 1873b)

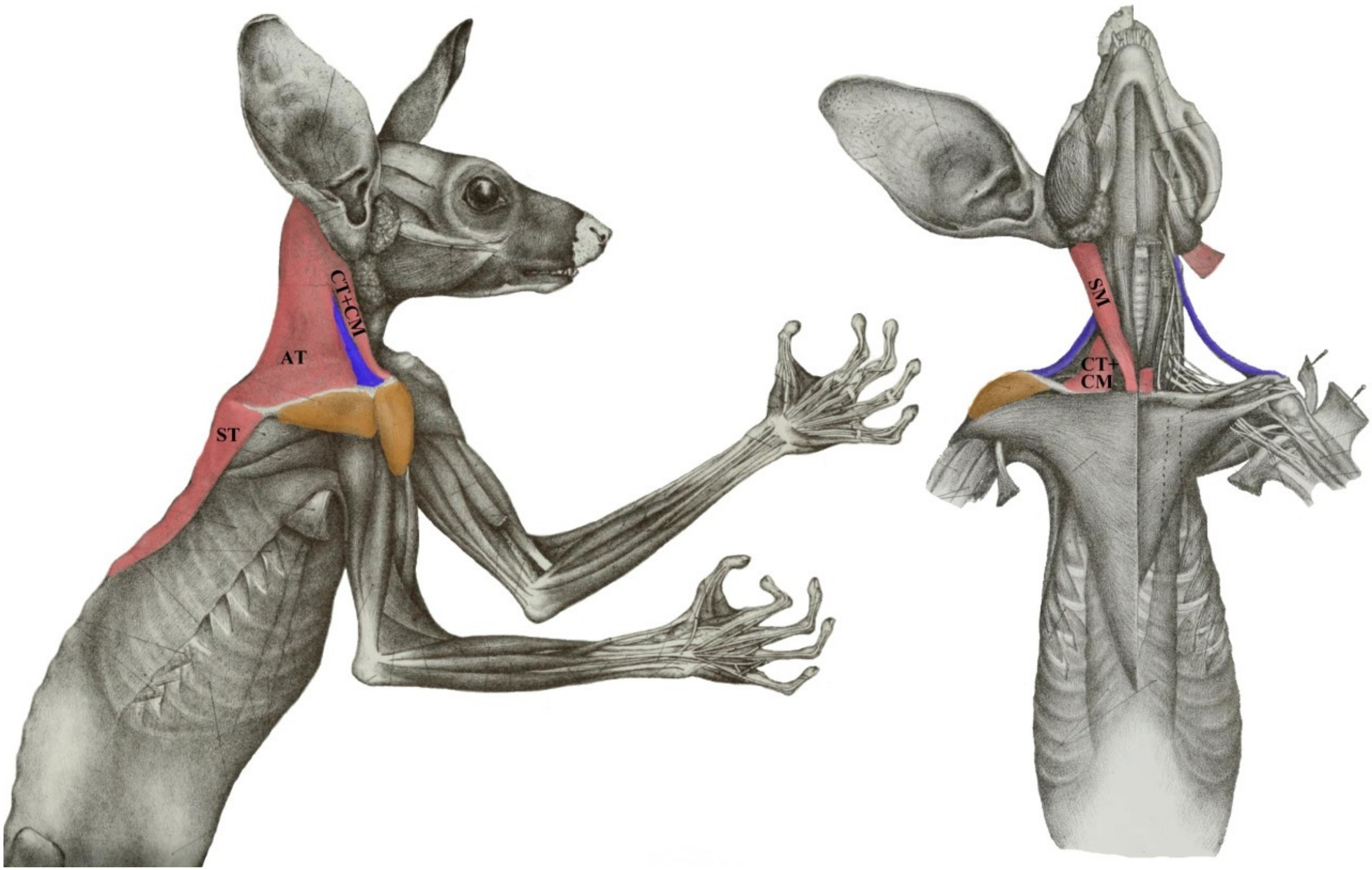


Figure A4-22. *Lemur* trapezius complex (modified from Murie & Mivart, 1872)

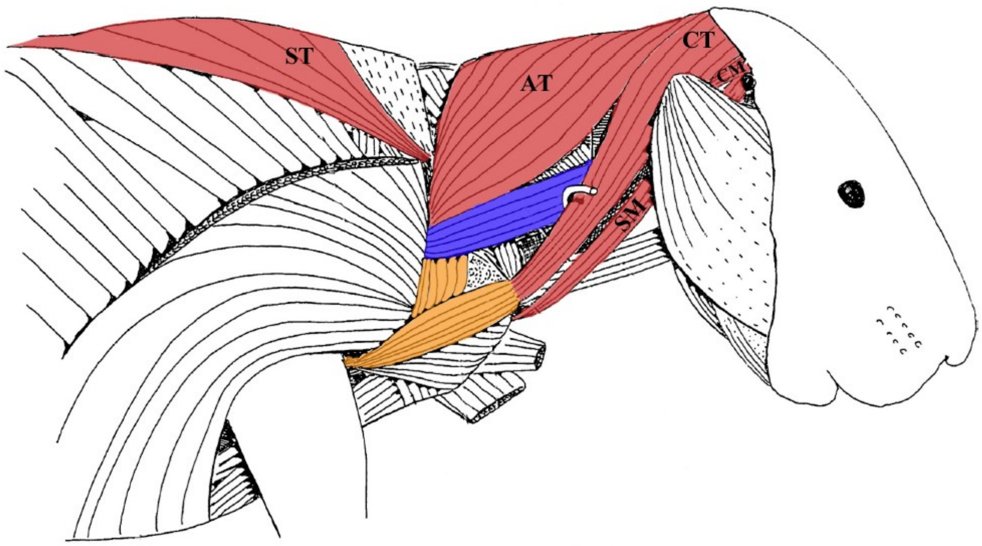


Figure A4-23. *Cavia* trapezius complex (modified from Woods, 1972: figure 9)

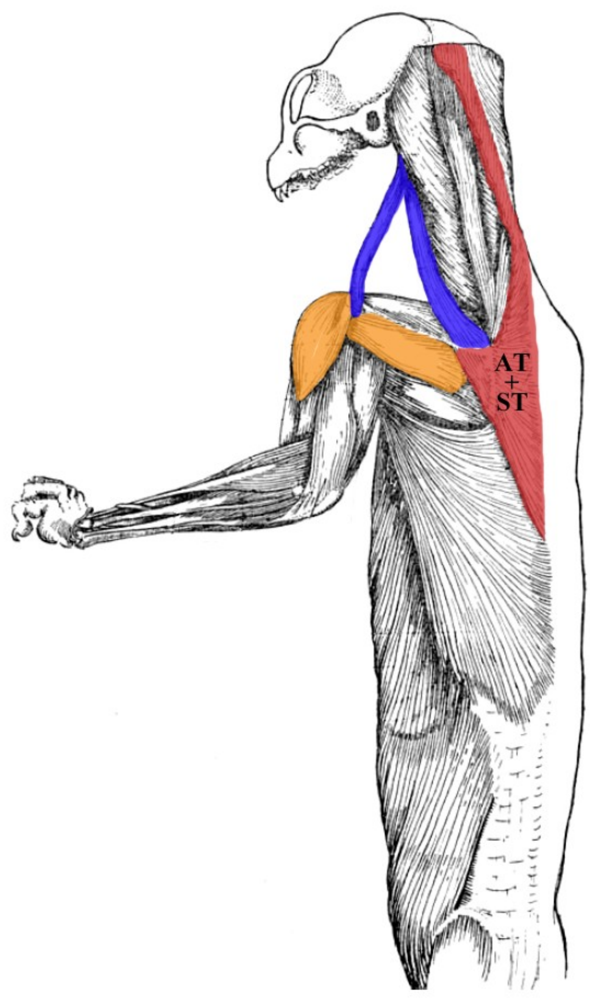


Figure A4-24. *Tupaia* trapezius complex (modified from Le Gros Clark, 1924)

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BIRTH

June 23, 1981 at Prentice Women's Hospital and Maternity Center, Chicago, Illinois

EDUCATION

Johns Hopkins University School of Medicine, Baltimore, Maryland. 2014
Doctorate of Philosophy, Functional Anatomy & Evolution.
Dissertation: Forelimb myology and the evolutionary relationships of the aardvark, *Orycteropus afer*, and other small afrotheres.

University of Chicago, Chicago, Illinois. 2003
Bachelor of Arts, Anthropology with General Honors

University of Dar es Salaam, Dar es Salaam, Tanzania. 2002
Exchange Student, Ecology & Evolution

FELLOWSHIPS AND AWARDS

American Association of Anatomists Student Travel Award (2009, 2012) – $350
American Society of Mammalogists Grant-in-Aid of Research (2009) – $450
Johns Hopkins School of Medicine Graduate Student Fellowship (2004 – 2009)
Field Museum Visiting Scholar Award (2008) – $700
Johns Hopkins Graduate Student Association Travel Award (2006, 2009) – $300
University of Chicago Dean's List (2000-2002)

TEACHING EXPERIENCE

Human Anatomy & Physiology – Mentor
Thetford Academy high school sophmore, at *Geisel School of Medicine, Hanover, NH.*
Instruction using cadaver prosections, skeletons, and anatomical models. (Sep. – Mar. 2013)

Human Osteology (ANTH 43) – Guest Presenter
Undergraduates, *Dartmouth College, Hanover, New Hampshire.*
Invited human anatomy demonstration with a focus on the upper limb (Nov. 2013).

Human Gross Anatomy (ANAT 111 & 112) – Laboratory Instructor
Medical students, *Geisel School of Medicine at Dartmouth, Hanover, New Hampshire.*
Assist students with cadaver dissections, help prepare practical examinations, tutor students, lead laboratory review sessions, lead small group discussions, lecture on "Anterior & Medial Thigh." (Aug. 2011 – present)

Human Gross Anatomy Review – Laboratory Instructor
Residents, *Dept. of Physical Medicine & Rehab, Johns Hopkins Medicine, Baltimore, MD*
Prepared cadaver prosections and gave laboratory presentations. (May 2008, 2009)

Mammalian Evolution (020.368) – Teaching Assistant
Undergraduates with Dr. Kenneth Rose, *Johns Hopkins University, Baltimore, MD*
Created course website, wrote and graded quizzes, tutored students. (Jan. – May 2007)

Human Gross Anatomy (130.601) – Laboratory Instructor
Medical and graduate students, *Johns Hopkins University School of Medicine, Baltimore, Maryland.* Assisted students with cadaver dissections, graded presentations. (Nov. 2006 – Feb. 2007)

Mammals: Diversity, Structure, and Evolution (130.707) – Guest Lecturer
Graduate students, *Johns Hopkins University School of Medicine, Baltimore, Maryland*
Gave lectures on Mammalian Osteology, Australian Marsupials, and extinct suborder Taeniodonta. (Sep. – Oct. 2006)

Summer Institute in Anatomy – Laboratory Instructor
Undergraduates, *Johns Hopkins University School of Medicine, Baltimore, Maryland*
Prepared cadaver prosections, gave laboratory presentations, graded exams, offered review sessions. (June 2005, 2006, 2007)

Low Synchronized Skating Team – Assistant Coach
Rochester Figure Skating Club, Rochester, Minnesota
Coached and choreographed synchronized skating routines and performed first aid for a team of 20 girls ages 8-12. (Sept. 1997 – Sept. 2000)

RESEARCH & PROFESSIONAL EXPERIENCE

Research Assistant – Mammal Fossil Collection
Dr. Kenneth Rose, Johns Hopkins University School of Medicine, Baltimore, Maryland
Cleaned, repaired, identified, and catalogued Eocene fossil mammals. (June 2006 – June 2008)

Research Project – Functional Anatomy of *Arctictis binturong*
Drs. Rebecca Fisher and Jason Organ, Smithsonian Osteological Preparatory Laboratory, Suitland, Maryland. Dissection and description of the hind limbs of two frozen zoo specimens of *Arctictis*. (October 2006)

Research Rotation – Premolar Microwear of New World Monkeys
Dr. Mark Teaford, Johns Hopkins University School of Medicine, Baltimore, Maryland
Analysis of the premolar microwear in a hard object specialist (*Cebus apella*), a seed predator (*Pithecia pithecia*), and a frugivore (*Ateles belzebuth*) using a scanning electron microscope. Premolar microwear may be able to differentiate between primates that use their premolars to open hard objects and those that do not. (Sep. 2004-Sep. 2005)

Clinical Assistant – Bosley Medical, Chicago, Illinois
Dissected follicular units for use in hair transplantation procedure, reorganized current and archival file rooms, and sterilized surgical instruments. (June 2003 – June 2004)

Research Project – Pliocene Paleoenvironment of Laetoli, Tanzania
Dr. Audax Mabulla, Associated Colleges of the Midwest Tanzania Program, University of Dar es Salaam, Dar es Salaam, Tanzania. Collected, cleaned, and identified 275 fossil teeth and jaws from Upper Laetolil deposits (Pliocene) in Laetoli Gorge for a habitat analogy which indicated that Australopithecines lived with a diverse range of fauna in a mosaic environment composed of woodlands with permanent water, seasonal grasslands, and arid patches. (Sep. – Dec. 2002)

Dinosaur Giants On-Site Coordinator – Project Exploration, Chicago, Illinois
Supervised high school volunteers at the SuperCroc exhibit at The Museum of Science and Industry. (Mar. - May 2002)

Office Intern – Professional Skaters Association, Rochester, Minnesota
Answered phones, maintained files, managed a computer database, made travel arrangements. (June – Sep. 2001).

FIELD EXPERIENCE

Fieldwork with Dr. Erik Seiffert, *Stony Brook University, Stony Brook, New York*
Late Eocene and early Oligocene mammals in the Fayum Depression of northern Egypt (Oct. 2009)

Fieldwork with Dr. Kenneth Rose, *Johns Hopkins University School of Medicine*, *Baltimore, Maryland*
Early Eocene mammals in Vastan Coal Mine, Gudjarat, India (Feb.- Mar. 2006)
Early Eocene mammals in the Bighorn Basin, Wyoming (July 2005, 2006, 2007, 2009, 2014)

Field Courses, *Associated Colleges of the Midwest Tanzania Program* (Sep. 2002)
Dr. A. Mabulla: **Pleistocene archaeological and paleontological sites, Olduvai Gorge & Lake Eyasi, Tanzania**
Dr. J. Kabigumila: **Survey of habitats and animals in Serengeti National Park, Tanzania**

Field Course with Dr. Paul Sereno, *University of Chicago, Chicago, Illinois*
Prospected in the **Lance (Maastrichtian) of northeastern Wyoming** and prepared plaster jackets. (July 2001)

PROFESSIONAL ORGANIZATIONS

American Society of Mammalogists, Student Member (2009 – present)
American Association of Anatomists, Student Member (2007 – present)
Society of Vertebrate Paleontology, Student Member (2005 – present)
United States Figure Skating, Member (1991 – present), Singles & Pairs Gold Judge (2002 – present), Dance Bronze Judge (2013 – present)

PRESENTATIONS & ABSTRACTS

McKusick, G. 2012. The trapezius complex in Mammalia. Symposium on *Form, Function, and Evolution*, American Association of Anatomists Annual Meeting, San Diego, California.

McKusick, G. 2009. Forelimb anatomy of the aardvark, *Orycteropus afer,* (Mammalia, Tubulidentata). *FASEB JOURNAL 825.6*

McKusick, G. and Teaford, M. 2007. Premolar microwear of three New World monkeys: *Cebus apella*, *Pithecia pithecia*, and *Ateles belzebuth*. American Journal of Physical Anthropology 132 (S44): 110.